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The Rogers Park Water Rates Case.

People who have money invested in the stocks and bonds of public service corporations will be gratified to learn the decidedly outspoken condemnation by the Illinois Supreme Court of an attempt by the officials of Chicago to impose unjust rates on the Rogers Park Water Co. The plant was built in 1888-89, when Rogers Park was a suburban village containing about 300 houses. The contract between the village and company called for an initial plant of 1,500,000-gal. capacity, with a pressure in the mains of 60 lb. The supply was to be filtered Lake Michigan water. Private and public rates for water were embodied in the contract, which was drawn with more care than is usual with such papers.

In 1891 the Legislature passed an ordinance giving municipal authorities the power to prescribe by ordinance maximum rates for the supply of water by individual companies to cities, towns and villages and their inhabitants, "such rates and charges to be just and reasonable." In 1893, Rogers Park was incorporated with the city of Chicago, and four years later the Chicago city council passed an ordinance regulating the rates charged by the company. The latter fought this case through the State courts and in the United States Supreme Court, on the ground that the contract between the company and the village was for a period of thirty years and its terms could not be changed by legislative act without its consent. This case was decided against the company in each court. In 1902 the Chicago city council again passed an ordinance requiring the company to charge the same rates as the municipal water department. This ordinance the company has been fighting as unjust and unreasonable, and accordingly in violation of the spirit of the act of 1891, giving city authorities the right to fix maximum rates. The State Supreme Court has just upheld the company in a decision, 73 N. E. Rep. 375, which is so completely in accord with the views frequently stated by The Engineering Record that it is most satisfactory to refer to it in some detail.

It was thoroughly established by the testimony that the city council made no attempt to ascertain the cost to the company of supplying water. It simply made the rates the same as those charged by the city, contending that they were reasonable and just. The court points out that such a proceeding does not take into account any of the data which should be considered in establishing an equitable schedule. The testimony showed that the city could furnish water at a cost of less than 3 cents, while the cost to the company had never been less than 6.89 cents per 1,000 gal. The higher cost was due to the greater pressure on the mains, the smaller pumping capacity, the expense of filtration and local conditions which can be best indicated by a few examples. The city, for instance, has about 1,890 miles of mains, with a consumer for each 33½ ft. of pipe, while the company has a little over 22½ miles, with 120 ft. per consumer. The city plant cost $113 per consumer and the company's works $216. "With such disparity in cost of delivery, it cannot be held," the court says, "that uniformity of rates raises the presumption of reasonableness, but that the mere statement of the facts contradicts any such contention."

Such a decision in a specific case is gratifying in these days of sandbagging of public service companies by municipal officers, but another feature of the decision is still more valuable to those who wish to see cities compelled to act honestly. The following general observations of the Supreme Court deserve wide circulation: "We do not deem it necessary to enter upon a field of discussion involving the method and scope of the matters to be taken into account in arriving at just and reasonable rates. Because of the great diversity and marked difference in plants performing in some degree the same functions, each attended with its own peculiar conditions and difficulties, it may well be doubted if any general rule has been or can be formulated that will control in all such cases; but, in the exercise of a power such as is conferred by the act of the Legislature under which the city claims to be acting, due regard for property rights must be observed. While the cost to the public of the service rendered by such companies and its regulation are matters of undoubted importance, so, too, are the rights of the owners of plants who have put into them their means and energy and devoted them to the public service. Whatever the rule may be, it must be admitted that the effort or purpose to reach uniformity must not be carried to extremes, by attempting to make unlike things alike."

Recent Doings in the New York Building Department.

It is a failing of many men to look upon a responsible public office as a fitting mark of distinction with which to round off a life of earnest and successful business enterprise. These prominent places are sought by them for the prestige they afford the incumbents. They do not recognize the snares and pitfalls and entrust the management of details to untried political associates taking office with them or to old employes of whom they know nothing personally. They would not think of doing such a thing in their own business. They fail to recognize that it is only by hard and long-continued work that men like Mayor McClellan and President Roosevelt retain the confidence and esteem of the public.

Some recent doings in the New York Building Department suggest these thoughts very forcibly. Without going into the details of these occurrences which, while locally interesting, would not be understood readily by most readers of this journal, it is desirable to indicate the annoyances to which architects and contractors have lately been unnecessarily and peculiarly subjected. The superintendent of buildings of Manhattan, Mr. Isaac A. Hopper, is a retired wealthy contractor. He has the reputation of having done excellent work, and this journal is glad to say that it has never heard the slightest reflection on his character. It has always regarded him as one of the most competent builders in the city. For recreation he plays a very good game of politics, having risen high in the Tammany fold, like many other men who are affiliated with the organization for the fun of the thing rather than for strictly revenue purposes.

Mr. Hopper has long held the opinion that he would make a good superintendent of buildings, and this journal also thinks so provided he would administer the office with the same attention to detail that enabled him to lay aside a very satisfactory nest egg. The trouble has been that some of the most important affairs in his office have been handled by men who have brought discredit on him, on the Borough President who appointed him, and on Mayor McClellan. For example, he allowed a subordinate to put him in the position of turning practically all the testing of plumbing over to a single company. The monopoly this company thus obtained it utilized so speedily that the master plumbers were compelled in self-protection to make a very outspoken and vigorous protest. A little later a subordinate beguiled him into requiring all new plumbing of a certain class to be provided with one of two fixtures. One of these could not be used in the great majority of cases, and thus the other was forced on the builders. One of the most absurd and useless tests ever devised was adopted by Mr. Hopper to determine the merits of this class of fixtures. At another time, a subordinate persuaded Mr. Hopper to compel all elevators to be equipped with one of two patented safety devices. Certain classes of elevators cannot be equipped with either of them. One of them is of only limited applicability, and the other, which is apparently that favored by the men who are responsible for the requirements in question, was recently tried in Philadelphia with completely unsuccessful results.

These things are mentioned as proving the danger of attempting to run a great political office by proxy. It is because of them that a strong attempt is being made to force Mr. Hopper out of office. If he would discharge the men who beguiled him into adopting these ridiculous requirements, which threatened to add a seriously large sum to certain classes of building operations, he would partly regain the esteem which he long enjoyed. He has enough legitimate troubles to settle without arousing the opposition of all architects, builders and owners of large buildings by apparently promoting the sale of trade specialties. For example, he has to settle the responsibility for the collapse of the walls of a number of new buildings. In this work he would have the cordial support of the most influential part of the public had he not already diminished their confidence in him by his pronounced official partiality for goods made by companies in which local politicians are interested.

Cost Plus a Fixed Sum.

The various methods of paying for construction have been the subject of much discussion for many years, but the latest of these to occupy a prominent place, the system of paying the actual cost plus a fixed sum to the contractor, is comparatively novel. It was taken up by Mr. Frank B. Gilbreth, of New York and Boston, a few years ago; in 1902 a little over half his business was done in this way, while to-day all of it is on this basis. In view of the diversified character of the many large works undertaken by this builder, such as dams, power stations, shops and even complete villages, the increase in favor of the system of payment on a cost-plus-fixed-sum estimate deserves consideration.

The early system of contracting, under which the larger part of the construction undertaken to-day is carried on, was based on a lump-sum bid. In simple work of well known character, where great speed is not required, this is probably the most satisfactory method to adopt. But as the difficulties increase, the system gradually develops marked defects. Bidders cannot foresee all troubles that may arise, and they either largely increase their bids to cover these probable but unknown contingencies or else take the risk of being overwhelmed with financial disaster. Either the owner or the contractor must lose considerable money when difficult construction is undertaken on the lump-sum basis.

The second system of payment was devised to meet defects of the first method. It is the plan of paying the contractor for his services a percentage of the actual cost of construction, as shown by the books kept for the work. This frees the contractor from any bias toward skimping materials and workmanship. Where owner and contractor have confidence in each other the system is a good one, but sometimes, when the construction has proved unusually difficult and tedious, the heavy cost has caused bitter controversy between the two parties. The owner has claimed that the contractor made the work unusually expensive in order to increase his fees, while the contractor has claimed that the owner demanded impossible things.

Under the cost-plus-fixed-sum plan, which Mr. Gilbreth is now using on his work, the owner knows from the outset just what profit the contractor will make. It is not altered by deviations from the estimates of the cost, and the contractor has no incentive to produce anything but the best work. The owner can purchase the materials himself or allow the contractor to do so, the latter being usually the better plan. Changes can be made in the plans without any objection by the contractor. When time is precious the foundations can be started before the details of the superstructure are completed. In short, the whole arrangement makes the contractor a sort of professional man, retained at a definite fee for a definite purpose. Such a system on large undertakings manifestly has much to commend it. Its merit as a preventative of controversy deserves recognition.

Concerning Load Curves.

From the earliest days in which electric-power plants began to be operated in a scientific manner, the load diagram has offered an instructive means of graphical analysis. In many stations the advantages of such curves have been appreciated for years, and the operating records of the more progressive installations are replete with diagrams taken under many and varied circumstances. There is no need at this time to point out the zeal with which many manufacturing industries have also taken up curve plotting for the sake of showing the variations of output on a time basis. These diagrams are, in reality, as good examples of load curves as anything produced by electric plants; but in view of the ease with which curves may be prepared in installations where the entire output is recorded and indicated by instruments specially designed for the purpose, it is strange that in so many power plants nothing is done in the way of curve plotting.

Of course, it is easily possible to overdo in the matter just as the card index idea may be allowed to enslave an entire office. When the load upon a plant passes through similar daily or weekly cycles there is certainly no object in regularly plotting detailed diagrams, showing the half-hourly fluctuations of coal consumption, kilowatts supplied to this feeder or that, and so on. Such work carried to excess becomes a burden, not only to the employes of the engine and fire rooms, but to the superintendent and manager as well. As long as things are going smoothly, it is a good plan to let a few days elapse between the presentation of each set of diagrams to the busy executive. The important readings and records should be taken without any breaks in their continuity, but it is better to present them on a single combined diagram for a week or a fortnight, upon which the variations may instantly be noted, than to permit single curves of no special interest to filter into the manager's office day by day, and thus needlessly absorb his attention and time.

It is naturally quite a problem to know where to draw the line, in more senses than one. Some managers desire to know each morning the previous day's output and coal consumption, and others like to find upon their desks each day curves or figures showing what the plant is doing in greater detail. Generally, however, it is only the main facts that are desired at such frequent intervals, and these can easily be submitted, the comparison for several days being carried along on a single sheet of cross-section paper. The point is, not to waste time plotting unimportant data at very frequent intervals. The average amount of oil consumed by the plant in a week or a month, for instance, is a far more impressive figure than the daily fluctuations in the consumption of that commodity, so long as those fluctuations do not become excessive. This is exactly the point where nice judgment is needed to carry on the work of graphically recording the input and output so that the resulting curves will be significant, enabling intelligent comparisons to be made and sound conclusions to be drawn.

At intervals, determined by the conditions obtaining in each plant, therefore, it should be the custom of the company to secure the detailed data from the operating shifts which will enable analyses to be made of the conduct of the business. There can be no doubt that the graphical method is the simplest, and at the same time the most effective, way of comparing these different results. If such curves or data are regularly prepared, they are sure to be of great value when the day arrives in which either the company's engineers or outside consulting experts are called upon to draw plans and specifications for extensions or other alterations of the equipment. Not only do records and curves thus prepared in the regular routine of business possess particular value because of their derivation, they also save a notable amount of time and money necessarily expended under less favorable conditions for the acquirement of the very information which they present.

Thus an isolated plant in an office building finds itself overloaded during business hours, and the question comes up, whether an additional unit shall be installed, a storage battery enlarged in plate capacity, or power purchased in part from a nearby central station to help the plant at its peak. Unless the load upon the plant at different hours, the service performed by the existing equipment, the fuel, water, labor and supply accounts are known with reasonable accuracy from records filed or plotted in the past, a reliable decision cannot be reached. Unless a hap-hazard guess is to be made in the matter it will be necessary to delay the figures until the data can be secured, and in nine cases out of ten this will require from a week to a month. How much more satisfactory it is to base figures in propositions of this character upon the tabulated or plotted records of at least a year, in which the varying conditions accompanying the different months and seasons exhibit themselves in regular service.

Aside from the usefulness of load curves in cases of extension, their advantages in showing the way toward operating economy are noteworthy. A peculiar feature of electrical supply on a large scale, whether it be in telephone, central station or railway work, is the peak which the traffic shows at certain hours of the day. This extraordinary demand on the part of consumers is an old story to every manager, and many efforts have been made to reduce the ratio between the average and the maximum output known as the load factor. Manifestly, the desired condition to be attained is that in which all the machinery except a limited quantity held in reserve against breakdown is operated continuously at its full rated capacity, in which case the idle investment is reduced to a minimum. Ideal conditions of this sort are seldom reached in practice, except in some kinds of electro-chemical or manufacturing industries in which the load in toto varies but little. At the same time, the condition of operating at full capacity can be approached, at least for individual machines, and in order that the service of such units may be intelligently planned, the study of minima, averages and maxima in output as exhibited in load diagrams is a necessity. Many of the facts required can be most easily plotted on a time basis, the inputs and outputs of various sorts appearing as ordinates.

That there is still room for wider appreciation of the value of load curves cannot be doubted as one observes the number of occasions in the preparation of estimates where assumptions have to be made in the selection of ratios which ought to be known for the case in hand from operating data. Thus the variation of the ratio of maximum to average demand upon the railway power station as the number of cars supplied by it increases or decreases is a matter which is open for investigation through load-curve analyses. This question comes up in the design of nearly every new electric railway, and in so many cases has the ratio been assumed by individual judgment based upon rather hazy recollections of the behavior of the station ammeter at odd times that the resulting determinations of equipment are often of questionable accuracy. Whatever managers may think of the load-curve proposition, such data are well worth considerable effort on the part of engineers to obtain. They supply to the engineer information of the same basic character that a capitalist demands from promoters seeking to interest him in a business venture.

Notes and Comments.

A Tremendous Scare was worked up on Tuesday about the new Croton dam. One paper announced in large type that an army was fighting to save the dam, and men were being rushed to it from all nearby villages to strengthen it where the pressure seemed greatest. It was, of course, an absolutely baseless scare. The structure is no more endangered by the spring floods than is the pyamid of Cheops by a gentle dew.

The Collapse of a Water Tower, which was reported as occurring on March 15 at Slater, Mo., was not so important as stated in the dispatches. The structure was merely a home-made 50,000-gal. pine tank on a pine tower, and collapsed, so the superintendent, Z. T. Stevens, writes, through lack of hoops and paint. It was twelve years old. Wooden tanks need attention, and this accident and the consequent four days' shut-down of the electric light and water works at Slater have probably convinced the city council of the desirability of appropriating money for enough paint, hoops, and such things.

The Word "Bridge" has recently been held by the U. S. Circuit Court of Appeals, Sixth Circuit, to include both substructure and superstructure. The decision was made in an interesting case, 134 Fed. Rep. 353, arising from the determination of the Cincinnati & Muskingum Valley R. R. Co. to replace the wooden superstructure of a bridge over the Muskingum River with one of steel. The Federal authorities endeavored to stop this construction on the ground that Congress had forbidden the erection of any bridge across that stream unless it conformed to certain requirements. The railroad company claimed that it had no intention of erecting a bridge as it merely intended to reconstruct one which was too light for the traffic, using the same piers as before. This contention was sustained by the court, which held that so long as the piers were not replaced, the work was of the nature of renewal rather than original construction, such as comes under the Congressional act.

A Remarkable Tunnel Accident occurred on the New York Rapid Transit work between Battery Park and Brooklyn on March 27, when a man was blown from the tunnel through a rift in the river bottom and the water above, without serious injury. According to his statement to various reporters, he was working on the apron of the shield used at this place, when he noticed a blow-hole in the earth. This he filled with a couple of bags of sawdust, kept handy for the purpose. A little later another blow-hole was suddenly formed in the front wall, "a big, jagged hole, and the air was rushing through it with a noise like the noon whistle." He stepped forward to put similar bags in this hole, when he was forced into it by the current of compressed air and literally blown through the river bed into the water, from which he was picked up by a rowboat. Several companions working in the shield at the same time were rescued by the gang of muckers in the tunnel before the heading was flooded by the water coming through the hole.

The Isthmian Canal Commission recently received very severe criticism of its sanitary work in a report to Secretary Taft by Dr. C. A. L. Reed, which was published in various papers. The Washington authorities do not agree with the medical critic, and this fact should be made public. President Roosevelt wrote on March 20 that the statements which Dr. Reed made "were in many instances unwarranted by the facts and his accusations in many instances unsupported by proof." The President evidently is not surprised at this, for he adds that "Dr. Reed has not displayed in this report the qualities of temperament or the power of accurate judicial observation needed to make a report valuable to the Government." Secretary Taft has also given expression to the same opinion, for on March 17 he wrote: "His charges against the Commission were biased and controversial and not written in the judicial spirit that inspires confidence in their justice and accuracy." These comments are particularly interesting as showing the intention of the two leading official critics of the Commission to prevent any unjust accusations against its work from receiving Government approval.

The Cost of Road Improvements is often so great that it ought not to be assessed for immediate payment on the land directly benefited. The failure to recognize this fact has often retarded desirable improvements, which might very properly be made by the issue of bonds and the establishment of a sinking fund provision of some sort. This idea is brought out in a report of the New York Senate Committee on a constitutional amendment authorizing the State to issue $50,000,000 road betterment bonds. The report reads as follows: "It is believed that since the roads so improved would exist for the use of generations yet to come, it would not be unwise to cast upon them a portion of the burden of paying the debt contracted for the purpose of improving the roads. The proposed amendment is broad enough, so that if in the development of road improvement it shall seem wise to some future legislatures to pay the entire cost in the first instance of improving the roads in some poorer sections and to permit the county and towns to repay to the State their share of the cost in partial payments, that may be done." It is not at all unlikely that some such plan as this, whereby the wealthy parts of a State practically lend their financial credit to the other portions, will prove one of the important factors in the much needed extension of good roads in rural districts.

A Non-Fillable Reservoir has been causing the water department of Shippensburg, Pa., considerable trouble. It was built in 1903-04, beside an old reservoir dating from 1886. The bottom and slopes of the latter were puddled by the contractor, but when the water was turned into the basin it leaked out in a very short time. Repairs were made, including repuddling, but the water broke through when it was again admitted to the reservoir. The interior was then planked, but this proved unsatisfactory. The new reservoir is lined with concrete 9 in. thick, laid in slabs with the joints filled with asphalt. When the excavation was made a number of holes and chambers were discovered in the rock on the bottom and slopes, which were filled with stone and concrete. The asphalt did not adhere well to the concrete slabs and apparently allowed the water to leak through the joints into the fissures below. The concrete cracked in many places on the slopes, and these cracks were cut out and filled with asphalt. When the basin was filled, the lining failed at two corners and on the bottom. The alternate filling and repairing were repeated four times, and finally, when there was 12 ft. of water in the basin, one side went out from the crest to the bottom. At this place the ground is a soft soapstone clay and rotten soapstone. The water leaked through this material to the bottom of the hill, where it came to the surface and entered a small brook. Supt. B. F. Landis, who has furnished this information, attributes the failure to the unsatisfactory character of the joints between the concrete slabs.

Competitive Water Purification Tests have been decided upon by the authorities of Paris, France, who will receive at the Bureau of Water and Sewers until May 15 the plans of those desiring to compete. Those projects that are deemed worthy of trial will be selected by a commission, and part of the expense of constructing the plants will be borne by the city. The duration of the tests will be determined by the commission. Where the purification is attempted chemically, the effluent must be limpid, of agreeable taste, sufficiently aerated, free from large amounts of organic matter and from more than 5 bacteria per cubic centimeter. Where the purification is by filtration the same physical properties must be attained, but the maximum number of bacteria is fixed at 50 per cubic centimeter. Prizes of $200 to $600 will be given to the best of the systems which satisfy the conditions. The tests are to be conducted under the general supervision of the prefect of the Seine.

An Auxiliary High-Pressure System has been designed for fire protection in a portion of Toronto, Canada, in connection with which, according to a report of Mr. C. H. Rust, city engineer of Toronto, it was first proposed to install five gas-driven pumps, four of them to have a capacity of 1,200 imp. gal. per minute, and the fifth 750 gal. per minute. Plans are now being prepared in Mr. Rust's office, however, for a much larger equipment in the pumping station, embracing four 5,000,000-gal. turbine pumps, two to be driven by electric motors and the other two by steam turbines. The pressure at the pumps will be kept at 300 lb. during fires, which, it is said, will give an average pressure of about 250 lb. at the hydrants. Eight or nine miles of special fire mains, tested at a pressure of 800 lb., are to be laid, and the report states that these mains, when not in use for fire purposes, will be kept under regular city pressure. The mains are to be laid not less than 6 ft. below the surface of the ground, as a protection from frost. Laterals will be run in both directions from a large central main and cross-connected at intersecting streets. It is proposed to install 120 hydrants, placed not less than 300 ft. apart, with two hydrants at diagonally opposite corners of each street intersection. Controlling valves are to be placed at each street intersection, and a valve will be placed in the middle of long blocks, permitting any length of pipe to be cut out for repairs. The water supply for the system is to be obtained from an arm of Lake Ontario, a 4-ft. steel serving as the intake main.

Unusual Regularity of Detail was secured in the design of the steel work for the two 138x64-ft. 10-story dormitories for Columbia University, New York, built by the J. B. & J. M. Cornell Co. Each building has 46 columns in two-story sections, and all of them are made with the same outside dimensions, although the sections vary to correspond with the increasing loads in the successive stories. In the upper part of the building the columns are made of pairs of channels, latticed, and in the lower stories they have closed rectangular cross-sections made of two channels and two cover plates. In all cases the channels are 8-in. deep, and are spaced the same distance apart, back to back. All joints are flange-and-web-spliced, and have a 12x½-in horizontal diaphragm plate and a pair of 10x⅜-in. vertical web splice plates, field riveted to both sections of the column. These pieces are all interchangeable duplicates, so that 600 10-in. plates and 300 12-in. plates were made from the same templates and required no marking or fitting. All splices were precisely alike, and were made much more quickly and satisfactorily in the field than if there had been variations.

THE GENERAL DESIGN OF THE QUEBEC BRIDGE.—I.

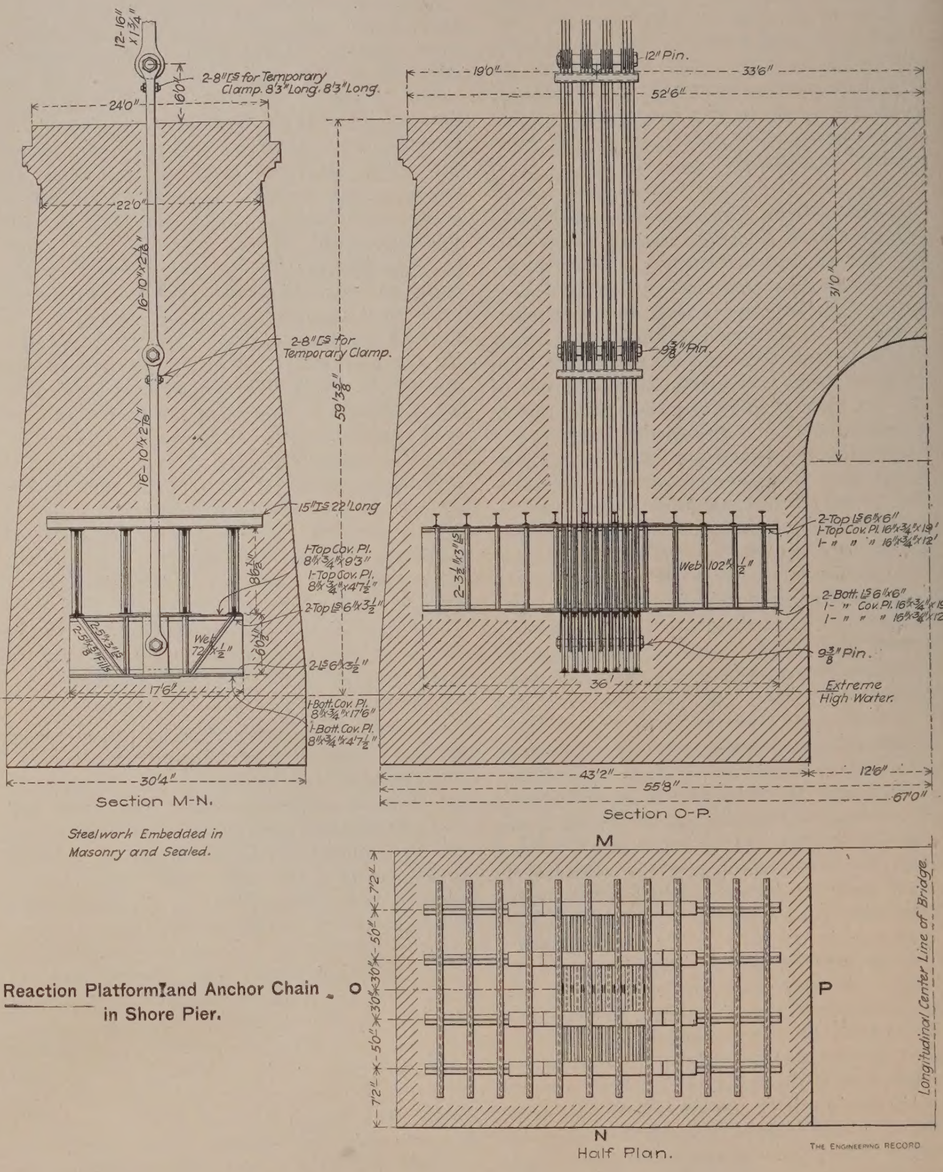
The Structural Features of the Longest-Span Bridge Yet Undertaken.

According to the terms of a contract signed last April, the 2,800 ft. of main spans of the Quebec bridge across the St. Lawrence River must be completed by Dec. 31, 1908. This allows about four and a half years for the making and verification of a large number of long and intricate calculations; the general design and dimensioning of all the members, many of which are of unprecedented size and demand novel treatment; the rolling of special steel; shop manufacture, inspection, testing and the erection of about 80,000,000 lb. of the highest grade steel work that can be produced. Work was commenced in the summer of 1900 on the substructure, which was finished in 1903, and during the past season the installation of erection plant at the site has made good progress, as described in The Engineering Record of March 4, in an article which also gave the principal dimensions of the bridge and other data. The bridge derives its greatest interest from its unprecedented dimensions; the development of its design and construction methods from the accepted American standards for heavy railroad bridge work; the special features of the permanent and temporary work; the rapidity and economy with which it is planned to construct and erect it, and because it is to be designed and built wholly by one bridge shop, which will manufacture nearly all the steel, execute the shop work and erect the structure entirely under the direction of its regular engineering corps and without interfering with the regular business and output of the plant.

With the single exception of the Forth bridge, no trussed span has ever yet reached half the length of the Quebec bridge. The Forth bridge spans lack 90 ft. of the length between pier centers of the Quebec bridge, and its trusses are of peculiar design, and were built piecemeal at the site and largely in position by a vast plant of special machinery. The Quebec bridge members are of types usually adopted for bridge construction in America; they are being wholly completed at the shops by standard machine tools, nearly all of which have been installed for the ordinary business of the contractors, and will be used for the construction of much other work in the same shops while this bridge is being built.

The main superstructure is symmetrical about the center line, and consists of a 675-ft. center span suspended from the extremities of the two 562½-ft. cantilever arms which are continuous across the river piers with the 500-ft. anchor arms, as indicated by the photograph from the model published March 4. The two pin-connected trusses are in vertical planes 67 ft. apart and have maximum depths of 315 and 130 ft. on the piers and at the center, respectively, and are 98 ft. deep at the ends. The center or suspended span has trusses with curved top chords, and is much the longest simple truss span yet built, the next longest being the 546½-ft. span of the Louisville bridge, built by this same company. Both top and bottom chords of the cantilever trusses are parabolic curves and the lower chords of the river arm cantilevers are carefully designed to harmonize with the top chord of the center span and produce a graceful effect suggestive of an interrupted arch with skewbacks on the river piers. As the upward reactions at the anchor piers are always positive, the live and dead load is carried entirely by the river piers which have fixed supports for the feet of the main vertical posts, expansion and contraction being provided for by the connections between the ends of the cantilever and center spans and the shore ends of the anchor arms. The bridge has a minimum center clearance of 150 ft. above high water, and all traffic is carried on a single floor platform 120 ft. above the tops of the river piers and graded 1 per cent. from each end to the center of the bridge.

The bridge has been designed to sustain a dead load of about 6,000,000 lb. for the center span, 15,000,000 lb. for each river cantilever, 12,500,000 lb. for each anchor arm, and 8,000,000 lb. for the floor system, and a live load of two Cooper's E 33 locomotives followed by a train weighing 3,300 lb. per lin. ft. with provision for future increase of 50 per cent. in the locomotive and train weights on each of two railroad tracks; electric cars each with 56,000 lb. on each of two axles 10 ft. apart on centers on two tracks, and a 12-ton load on two axles 10 ft. center to center on any part of the highway floor. Provision is also made for two future cantilever sidewalks 5 ft. wide loaded with 100 lb. per square foot. The railroad floorbeams and track-stringers are proportioned to receive maximum concentrated loads imposed by Cooper's E 40 locomotives. No allowance is made for secondary stresses, for impact, temperature stresses, or for longitudinal stresses from brake action, and as the track is on a tangent none is necessary for centrifugal force. The wind pressure is assumed to be 25 lb. per square foot on double the exposed surface of one truss and on one side elevation of the floor, one-half of it being considered a moving load. The erection traveler, engines, rigging, platforms, etc., were computed to weigh about 1,114,000 lb. for each truss, and the maximum erection stresses developed when they are at the center of the span will be so great that a considerable amount of extra material has been put in the truss members to keep the unit stresses within the required limits.

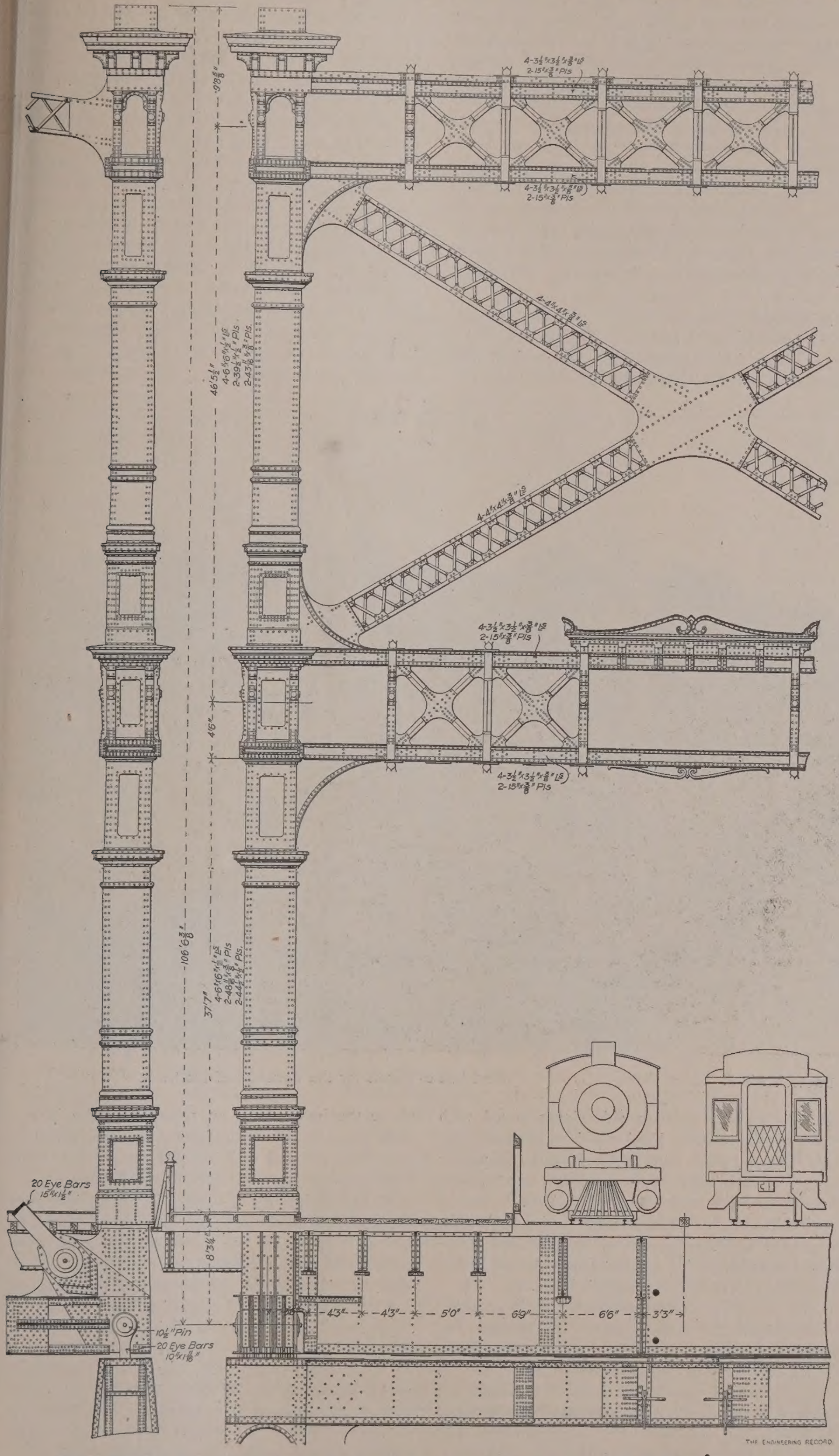


Reaction Platform and Anchor Chain in Shore Pier.

The maximum unit working stresses in tension are from 12,000 to 20,000 lb. per square inch. In compression members with lengths of more than 50 radii, these values are reduced by Cooper's formula. The maximum combined live and dead load stresses are the same in the top chords of the anchor and cantilever trusses and are 15,000,000 lb. They are provided for by thirty 15x1½-in. eyebars with a net aggregate cross section of 675 sq. in. The maximum diagonal member has twenty 15-in. eyebars stressed to 17,000 lb., and aggregating 454 sq. in. cross section. The maximum lower chord stress is 16,000,000 lb., and its cross-section 842 sq. in. The maximum lower lateral stress is 980,000 lb., and the section 66 sq. in. The maximum top lateral stress is 340,000 lb., and the section 17 sq. in. The maximum stress in a main vertical post is 5,100,000 lb., and the cross-section 370 sq. in. The maximum load on a river pier is 56,000,000 lb., the maximum uplift on an anchorage of one truss is 6,000,000 lb., and the minimum uplift 2,000,000 lb.

The anchor arms have ten 50-ft. panels, and ten panels in the cantilever arms, and the twelve in the center span are 56 ft. 3 in. The general out-lines and proportions of the bridge were designed to secure maximum rigidity, economy of material and a pleasing effect; the trusses were worked out to get the most advantageous distribution of materials and develop minimum stresses in the members. Their sections were designed entirely from combinations of standard shapes and commercial sizes, with the simplest possible arrangement and with careful regard to the capacities and efficient operation on them of standard machine tools in the bridge shops. Due consideration was given to their practicable shipment, handling, safety, rapidity and economy of erection in the field.

All secondary members and those in the lateral and sway systems have field-riveted connections. All floorbeam and stringer connections to each other and to the main trusses are rigidly riveted.



Portal Bracing, Special Floorbeam, Strut and Anchorage Connection at End of Anchor Arm Span.

All main-truss members are pin-connected at panel points; all pins are bored through the axis, and have their ends covered with pressed steel disks secured by through screw rods. For convenience in erection, and to reduce the bending moments and sizes of the pins, the top-chord eyebars in the river and anchor arm cantilevers are connected only to the tops of the main vertical posts, while the diagonals receive separate pins through large and heavy links fast on the posts. The long diagonal eyebars are each made in two lengths, connected to the intersecting vertical post by double pins through heavy jaw-plates riveted to the post. The panel-point splices of the lower chords are shop-riveted where there are changes of direction, and additional field-riveted splices are introduced in each panel a few feet away for convenience in erection. Where considerable machine work is required to finish the ends of very long and heavy members, these parts are made separate from the body of the member and riveted on after completion, thus obviating the necessity of handling the whole unwieldy piece at the machine tools. The size and thickness of eyebars were limited by the difficulty of forging thin wide bars, the impossibility of testing thick wide bars, the capacity of the plant to forge heads and the rolling lengths of bars of the required cross-sections. Some of the heavy plates used in riveted members were of the largest dimensions that could be produced by any rolling mill in the United States. The dimensions of some of the riveted members were limited to conform to the clearances required for shipment on the railroad, so that all could be finished complete in the shops as assembling only, but no part of the manufacture is contemplated at the bridge site. In one case, however, a special car had to be built to transport the pedestals for the river piers. The final designs for all very large and heavy pieces were made after preliminary sketches had been examined by the railroad officials and their transportation had been assured. Care was taken to make as many duplicate members as were practicable and in all riveted work great pains were taken to make the rivets accessible, especially those which are to be field-driven; where this is impossible, they are replaced by turned bolts.

The top lateral system consists of I-shaped transverse struts and X-braces 3 ft. deep, made of two pairs of 6x3½-in. angles, latticed. They are connected to the vertical posts by horizontal gusset plates field-riveted to connection angles. In each panel one of the diagonal struts is continuous and the other is cut to clear it, and both members are field-riveted to top and bottom flange splice plates. The lower lateral system has transverse struts connecting the feet of the vertical posts, and the panels between them are X-braced by rectangular struts made of four 6x4-in. angles, 25x½-in. top and bottom cover plates and latticed webs, 54 in. deep. The struts are cut and spliced at intersections like those of the top lateral system, and their ends are field-riveted between jaw plates projecting from the top and bottom cover plates of the bottom chords.

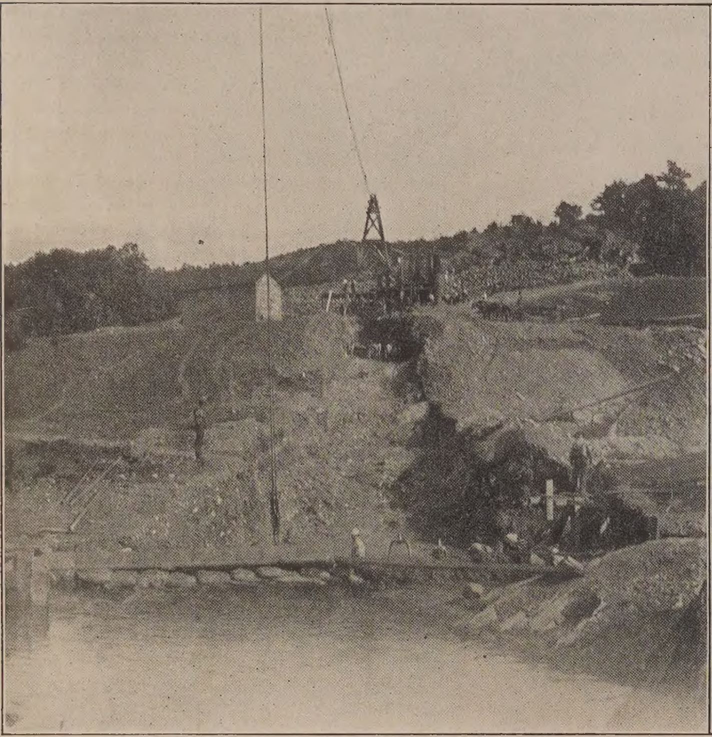
The sway-bracing consists of top, bottom and intermediate struts and X-braces, two or more double panels being made where the heights are great enough to make the angles more than 45 degrees for single diagonals, thus making, over the main piers, five panels of bracing. The members all have rectangular cross-sections about 3 ft. square, made of four angles latticed on all sides. At the anchorage piers the portal bracing consists of top and bottom struts connected by intersecting diagonals, as shown in the general elevation. The transverse struts are double lattice girders 9 ft. deep, with solid-web kneebraces which form jaws to receive the ends of the X-braces, having rectangular cross-sections about 4 ft. square, made of four 4x4-in. angles, latticed. The vertical end posts have steel cornices, paneling and mouldings and all connection plates on the portals are curved to give a pleasing outline.

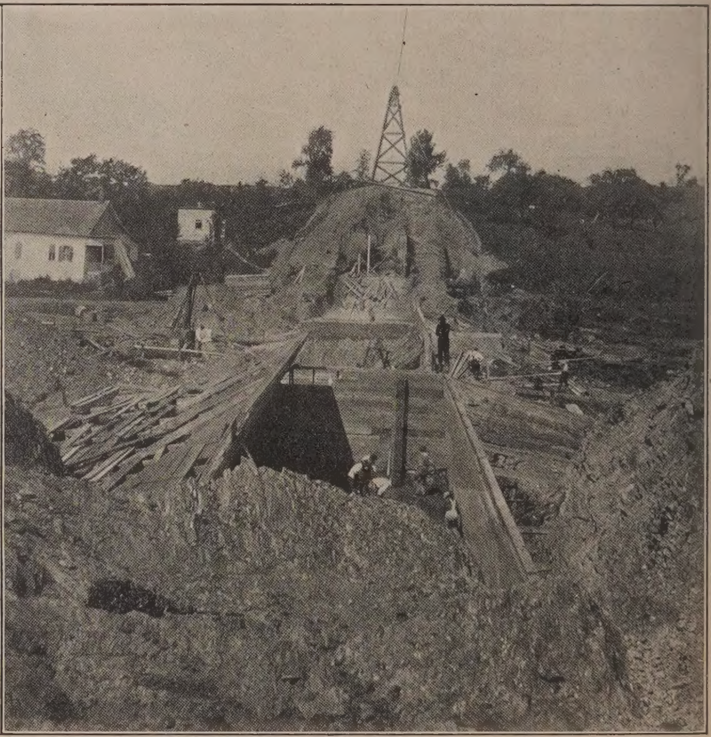
As there is always an uplift of from 2,000,000 lb. to 6,000,000 lb. at the shore end of each anchor arm truss, no pedestals are provided for the seats of these ends of the trusses, and they are simply connected to the anchorages by sets of sixteen eyebars with an aggregate cross-section of 330 sq. in. These bars are arranged in four groups at the upper end and passing through the reaction platform, separate into nine groups between the webs of eight distribution girders to which they are pin-connected. The distribution girders are built into the pier masonry about 3 ft. above extreme high water, and each is proportioned for a maximum flange stress of 273,400 lb. Their webs are reinforced to a thickness of 2⅞ in. under the two center platform girders, and pairs of inclined angles, like the diagonals of a truss, are riveted to the end panels of the webs to reinforce them under the outside platform girders.

Each girder weighs about 8,000 lb., and is connected to each platform girder with four flange bolts. The reaction girders have maximum flange stresses of about 480,000 lb., and weigh about 23,000 lb. each. Their webs are reinforced in the center by a pair of ⅝-in. plates 9 ft. long and by eighteen pairs of 3½x3x½-in. vertical stiffener angles. Both sets of girders and their eye-bars were assembled in position, and the spaces between and around the girder webs were filled with concrete and grout. A platform of 15-in. I-beams was set across the flanges of the reaction girders and on it was built the remainder of the pier masonry, having a total weight of about 24,000,000 lb. Narrow wells were left in the masonry around the eyebars, and the latter were kept in position by temporary clamps made with pairs of horizontal channels with notches cut in their flanges to receive the eyebars. These clamps were removed, and the wells were filled with grout, hermetically sealing the bars and leaving the anchorage inaccessible.

Mr. E. A. Hoare is chief engineer and Mr. Theodore Cooper is consulting engineer for the owners of the bridge. The contract for the steelwork and its erection was awarded to the Phœnix Bridge Co., of which Mr. David Reeves is president; Mr. John Sterling Deans, chief engineer; Mr. P. L. Szlapka, designing engineer, and Mr. A. B. Milliken, superintendent of erection.

(To be continued.)


Construction View at the Dam Showing Contractor's Plant.


First Lift of Forms for the Concrete of the Dam.

The New Gravity Water Works at Hudson, N. Y.

A storage reservoir and pipe line have just been completed at Hudson, N. Y., which furnish that city with a gravity supply from a catchment area adjoining the area at the upper end of the Roeliff Jansen Kill, on the east side of the Hudson River, which has been under consideration as a probable source of supply for New York City. Hudson is located on the east bank of the Hudson River, and the municipal water supply was formerly pumped from that stream to two open slow sand filters on a hill above the city. After passing through the filters the water flowed by gravity to a 3,200,000-gal. clear water reservoir on the same hill at an elevation of 310 ft. above the river and 175 ft. above the business portion of Hudson, and from this reservoir through the distribution system.

One of the filter beds and the clear water reservoir were designed and built in 1874 by Mr. J. B. G. Rand, and the second bed was built in 1888. Both beds and the clear water reservoir have concrete bottoms, with their side slopes paved with quarry-faced granite blocks laid in cement mortar. The first bed built is 330 ft. square, and the other one is irregularly rectangular, 290 ft. long by 250 ft. wide at its broad end, built to fit the available area. The combined sand area of the two beds is about 32,000 sq. ft., and their combined capacity under normal conditions of operation was formerly 1,500,000 gal. in 24 hr.

The raw river water, which is heavily charged with sediment at certain seasons of the year, was pumped directly on the filters, as a settling basin which appears to have been included in the original design was never built. Although the surface of the sand beds was scraped several times each year, the sand had never been renewed, with the result that the capacity of the beds became reduced to about 500,000 gal. in 24 hr., and their efficiency was also greatly diminished. During the winter months the heavy ice which formed on the water in the beds rendered scraping them a difficult operation, which at times became impossible. The sand would then become so clogged that in order to procure the daily supply a part of the river water would be pumped directly from the river into the reservoir. The conditions at the intake in the river also became unsanitary. The intake was about 800 ft. down-stream from the outlet in the river of one of the main sewers of the town, and 300 ft. upstream from another main sewer outlet, with a difference in level in the river of about 4 ft. between high and low tide. The river receives the sewage of Albany, Troy and several other cities before reaching the intake, and this, added to the local conditions, rendered the Hudson liable at all times to cause an epidemic of water-borne diseases.

After considerable investigation of the feasibility of constructing a new plant to filter the river water and of laying pipe lines to convey a supply from other available sources to the city, it was decided to abandon the old pumping station, erected in 1874, and to bring water from the Taughkanick Hills, which are about 13 miles from the reservoir on the hill above the city. The new supply is drawn from Claverack or Taughkanick Creek, about 15 miles from its mouth in the Hudson River. The catchment area above the intake is about 50 square miles in extent, made up of mountainous country, which is sparsely inhabited and comparatively free from liability of dangerous contamination.

The new pipe line is of cast iron, and has been designed to carry 3,000,000 gal. in 24 hr. The bed and banks of the creek at the intake are solid rock, and a channel, 8 ft. wide at bottom and 5 ft. deep below the surface of the water in the creek at its normal stage, has been cut across in the bed of the creek at a slight up-stream angle. The intake is a concrete box, 6 ft. square in plan by 10 ft. deep, built in the rock of the creek bank at the lower end of the channel blasted out of the bed of the stream. The bottom of the intake is about 6 ft. below the bottom of the channel, and its side on the stream face was omitted above the channel bottom and a movable screen of vertical iron rods placed across the opening. The outlet to the pipe line is a 16-in. cast-iron pipe provided with a screen at its open end in the intake and with a gate valve just outside the intake. A 12-in. cast-iron pipe blowoff, provided with a gate valve, is placed near the bottom of the intake.

The 13-mile pipe line has two sections, first a 5-mile length, ending in a storage reservoir built in connection with the aqueduct, and, second, an 8-mile length, leading from this reservoir to the distributing reservoir which was formerly used for a clear-water basin for the filters. The first 2 miles of the line from the intake on the creek are 16-in. pipe in two weights, one about 1,250 lb. and the other about 1,460 lb. per 12-ft. length, depending on the depth of the line below the hydraulic grade line. The remainder of the first 5 miles is 12-in. pipe in two weights, one 1,030 lb. and the other 1,200 lb. per 12-ft. length. A 12-in. pipe could have been used for all of the first 5 miles, but as the grade of the pipe, as it is laid, rises about 15 ft. above the hydraulic grade line near the end of the 16-in. pipe, pipe of that size was used in the first 2 miles and a cut, 800 ft. long, with a maximum depth of 30 ft. in hardpan, was avoided.

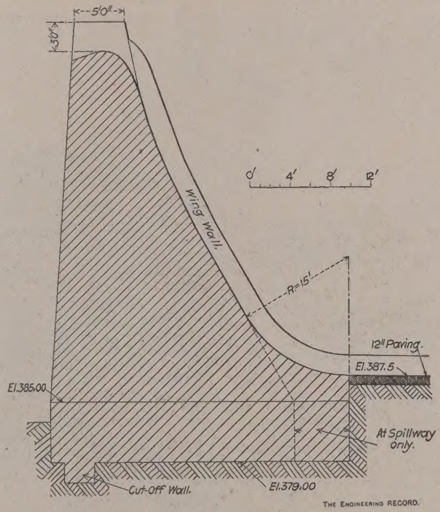
The storage reservoir in which the pipe from the intake terminates was made by building an overflow gravity-section masonry dam, 505 ft. long on the crest and 44 ft. in height near the center, across a narrow valley with steep sides. The dam develops a site which has a drainage area of 1⅓ square miles tributary to it, and provides an 82,000,000-gal. reservoir, covering a little less than 15 acres. The reservoir has abrupt banks on all sides, and with the exception of an area of about ¼ acre at one end, submerged only 4 ft., it will have a depth of 20 to 34 ft. The surface of the site was practically free from vegetation and organic matter, and was underlaid at a depth of a few inches with gravel, so the only preparation that was necessary was to plow the surface to a depth sufficient to turn the light top soil under the gravel. This was done over the whole area to an elevation of about 4 ft. above the flow line, and no trouble is anticipated from tastes or odors in the water due to organic matter.

Although the whole dam was designed as an overflow structure, the 40-ft. spillway built in it toward the north end is considered capable of passing any flow that may reach the reservoir. The dam is built on solid rock, which lies at a depth of from 5 ft. to 15 ft. below the original ground surface, and construction was begun by stripping the site down to this foundation. In the soundings for the dam it was thought that rock lay within 2 ft. to 4 ft. of the surface, but when the top soil was stripped, what was considered rock in the soundings was found to be a very dense hardpan, from 3 ft. to 12 ft. deep, overlying the rock ledge.

In making the excavation for the dam the top soil was first thrown back on either side by hand. A guyed derrick was then set up at the different points of the deepest cutting, and the excavated material spoiled below the site of the dam or hauled out of the trench in wagons, until a 550-ft. Lidgerwood cableway was erected longitudinally across the site. After the cableway was in place all spoil and concrete were handled in buckets on it. The small stream which formerly flowed across the site caused some trouble and had to be kept out of the trench by cofferdams on one or two occasions, but usually the work was comparatively dry.

While the excavation was in progress a stone crusher built by the Acme Road Machine Co., and a 1-yd. Ransome concrete mixer were set up adjacent to the hoisting engine and head tower of the cableway at the south end of the dam. The crusher was fitted with an elevating conveyor which delivered the broken stone to a bin over the mixer. The bin was fitted with a hopper measuring-box, which discharged into the mixer. The sand and cement were also delivered on an elevated platform over the mixer built in connection with the stone bin. A 50-h.p. vertical boiler supplied steam during the first part of the work, but later a 150-h.p. horizontal boiler was placed in a brick setting near the crusher and mixer, and furnished steam for all of the contractor's plant during the greater part of the dam construction.

The dam was built in 50-ft. sections, with a tongue and groove tar joint between the sections. As soon as the rock in the foundation had been stripped it was roughly leveled, and then the trench was completely filled with concrete to a sufficient depth to bring it level. The first lift of the forms was then erected, and the construction of the dam proper begun. Alternate 50-ft. sections were built at the same time. After the first lift of the forms had been filled, a 3-ft. layer of concrete was placed in one section on one day, then permitted to set a day while a 3-ft. layer was placed in an alternate section, after which another 3-ft. layer was placed in the first section, and so on. The surface of each layer was thoroughly brushed and cleaned, then wet and covered with a thin coat of 1:2 Portland cement mortar before the next layer was placed. This method of laying the concrete was followed in order that the forms might be built without exterior braces to hold them in place, and could be kept in position by transverse rods between the sides of the sections and by the curvature of the front face of the dam, the lower forms being removed as the concrete received its set. No leaks are apparent at any of the horizontal joints, and only a slight demarcation is apparent between any of the layers.



Cross Section of Dam through Spillway.

The concrete used in the dam was mixed quite wet in the proportion of 1 part of Hudson Portland cement, 2.8 parts sand, and 5½ parts broken stone, these proportions having been found to give a slight excess of fine material. A suitable sand was not procurable in the vicinity, so a bank was opened about 2 miles from the dam. The sand from it was found to contain from 6 to 8 per cent. of loam. Thorough tests were made to discover, if possible, the effect of the presence of the loam; as good results were obtained in these tests, the sand was used. The best stone available were the glacial bowlders which had been used in building stone fences in the vicinity, and after a considerable quantity of these had been used a quarry of trap rock was opened about ½ mile from the dam, and stone from it used in the concrete to complete the work. In the early part of the work the broken stone was screened, but the greater part of the concrete was made with crusher-run broken stone, in which the largest pieces did not exceed 2½ in. in their greatest dimension.

About 7,500 cu. yd. of concrete were required in building the dam. The actual cost of mixing and placing the concrete, including the materials obtained as described, and the cost of the forms with labor at $1.50 per day, but exclusive of the cement, was a little more than $3.65 per cubic yard. The 1.1 bbl. of cement used per cubic yard cost $1.25 at a railroad station 4 miles from the dam, and that amount was hauled to the site over a pike road for 27½ cents, making the total cost of the concrete $5.17 per cu. yd. The concrete was laid at the rate of 150 cu. yd. per day under normal conditions. Seventy-seven working days were consumed in building the forms and placing the concrete; and 146 days elapsed from the time ground was broken on the dam excavation until work on the dam was stopped on account of severely cold weather, with all but about 200 yd. of the concrete in place.

The 12-in. pipe of the line from the intake on the creek passes along the south end of the dam and the south side of the reservoir to an outlet about 6 ft. above the bottom near the upper end of the reservoir. A 6-in. branch on this pipe is laid from the dam toward the center of the reservoir where a half-bend was inserted, and the pipe built up to a point above high-water level. This branch will be used as an aerator if the water from the creek should need aeration at any time.

Water may be drawn from the reservoir through either of two 16-in. outlet pipes in the 16x18-ft. gate chamber that is built in connection with the dam. One outlet pipe has its center line 4 ft. 9 in. below the high-water level in the reservoir, and the other has its center line 21 ft. below that level. Both pipes discharge through screens in the wall of a transverse chamber in the gate chamber into an outlet chamber which is connected by an 18-in. outlet to the pipe line to the city. An 18-in. blow-off is laid through the dam beneath the gate house, and the reservoir may be drawn dry through it. All the outlet pipes are controlled by hand-operated gate valves.

The inlet to the reservoir and the outlet from it are connected by a by-pass permitting the reservoir to be entirely cut out of the system. An overflow is built in this by-pass, with its discharge at the same height as the high-water level in the reservoir, in order that the pressure on the main leading to the city may not exceed that due the head of water in the reservoir.

The 82,000,000-gal. capacity of the reservoir is about equal to 45 days' maximum consumption in the city. The normal consumption is 1,500,000 gal. per 24 hr., which is about 150 gal. per capita per day. The catchment area directly tributary to the reservoir site has given an average flow during the past two years of 1,200,000 gal. per 24 hr., with the rainfall from 3 to 6 in. below the normal, and the minimum flow to be expected from this area for any extended time is taken to be 750,000 gal. per 24-hr. The pipe line from the intake on the creek to the reservoir has been designed for a carrying capacity of 2,225,000 gal. in 24 hr., and the line from the reservoir to the city for a capacity of 3,000,000 in 24 hr. The depth of water in the reservoir, the excess of the supply over the demand and the depth below the surface at which water is fed into the reservoir are believed to produce sufficient currents and change of water to prevent any possibility of stagnation.

The pipe line from the reservoir to the city is of 16-in. cast-iron pipe in three weights, ranging from 1,250 to 1,675 lb. per 12-ft. length. No unusual difficulties were encountered in laying this part of the line nor in the line above the reservoir. The minimum depth of trench was about 5 ft., and this depth was maintained throughout the greatest part of the route. About 60 per cent. of the trench was wet, but no sheeting was required, and the water was removed with diaphragm pumps. Considerable rock cutting was required in making the trench, and two Ingersoll-Sergeant and three Rand steam drills were used in making the blast holes. Two creek crossings were made. One of them presented no difficult conditions, and the pipe was laid 3 ft. below the bed of the stream. Coarse gravel was encountered at the other crossing, and pipe with flexible joints was used to avoid pumping and building cofferdams. Air valves are placed on the pipe line at all summits and blow-off pipes at all low points.

The 4,000 tons of pipe required in building the pipe line and all of the gate and air valves and the valve boxes were furnished by R. D. Wood & Co., of Philadelphia, Pa. The contract for laying the pipe and building the dam was let to Hurd, Sherman & Co., of Syracuse, N. Y.

The saving in the operation of the gravity system as compared with the operation of the old pumping plant, is about $10,000 a year, including the salaries of three firemen and three engineers, and an average of 145 tons of coal per month. The estimated cost of rebuilding the old plant and enlarging its capacity to 3,000,000 gal. per day was $160,000, with an estimate life of the machinery in the remodeled plant of 30 years. The cost of the new works, including all charges and construction expenses will be about $270,000, with an estimated life of from 60 to 75 years.

While the average consumption of water per capita per day in Hudson is comparatively high, it will be difficult to reduce it to any considerable extent, owing to the peculiar conditions under which the water works system is operated. The original system was built under an act of the Legislature, which required that the works be built and operated with money obtained by a tax on the property in the city, and that water be furnished free for domestic consumption to any person paying the expense of installing a service connection. The system is still operated under that act, so the only direct income of the plant is the sale of a small percentage of the supply for commercial consumption, and the only opportunity of reducing the consumption under the present conditions is by metering the service connections of commercial consumers.

The filters are at present out of commission, but it is the intention to remodel them and filter the water from the gravity supply, and plans are now being prepared for the work. Mr. H. K. Bishop is chief engineer of the Hudson water works and the preliminary investigations, the design and construction of the new system have been carried out under his direct supervision. Mr. C. C. Vermeule, of New York, has been consulting engineer on the design and construction of the system. Mr. F. L. Getman was assistant engineer in charge of the laying of the pipe line, and Mr. H. W. Lewis was assistant engineer in charge of the construction of the dam.

Tarring Road Surfaces made of flint and gravel to lay the dust during the summer is stated by Mr. T. E. Ware in a letter to the "Surveyor," to have been attended with considerable success during the entire year. The tar is applied to a road which is dry and in good condition, and also more or less exposed to the sun and wind. All dust is removed and ordinary gas tar in a boiling state is then well brushed into the surface, as thin a coat as possible being applied. An hour or two after the tar has been applied, fine sand, usually that first swept from the road, is added. This treatment it is said, produces a dustless road that is practically noiseless and has a good surface for seven months in the year. Though the tarred surface is inclined to break up under wet and frosty weather, it does not become muddy and after a few days of good weather settles back again into a hard condition. If the traffic is continuous the road has to be re-coated in the spring at a cost of about 4 cents per square yard. The roads which have been treated are said to be subjected to a fair amount of general traffic and a heavy automoblic traffic, all of which is required to proceed slowly for two or three days over the freshly tarred surface.

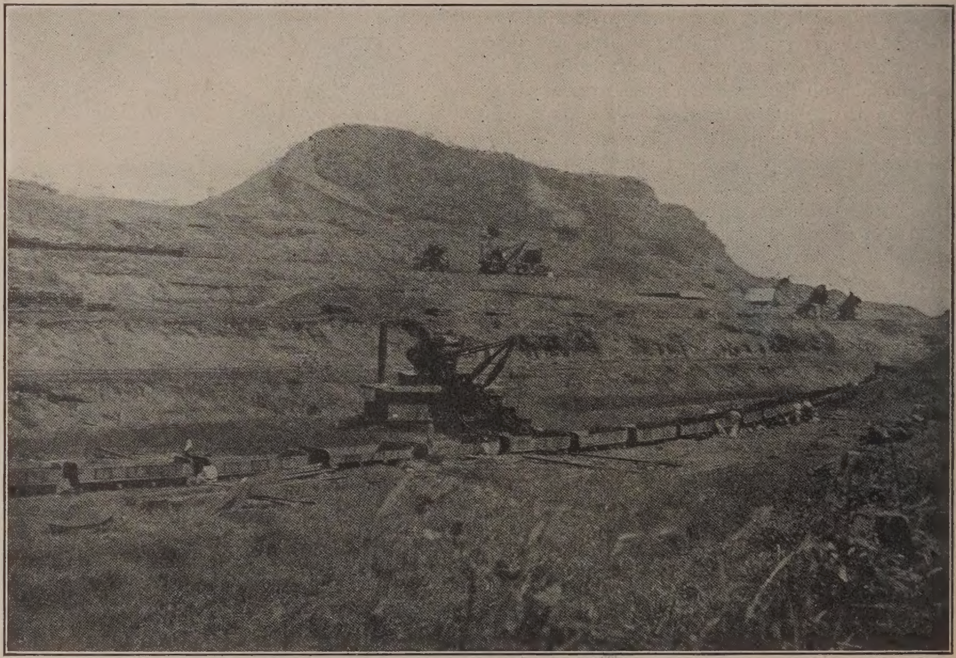
Panama in French Canal Times.

By W. F. Dennis, Consulting Engineer, New York.

The following notes on Isthmian conditions during the period when the operations of the old French Company were at their maximum, may perhaps have retrospective and comparative interest at the present day when the Unitd States is reorganizing plans and construction.

Early in 1888 the writer landed on the Isthmus to assume a position as engineer of the Panama Railroad. Landing was made at the city of Colon, which lay flat on the edge of a coral rim 5 ft. above sea-level. Wooden houses, corrugated iron roofs, occasional palm trees with a background of green conical hills made the landscape. Jamaican negroes were everywhere mixed in with Spanish-speaking natives, almost equally dark, grading up through various brunette shades to the pure blooded Colombian of Spanish descent, whose ancestors may have lived at Panama since 1513, together with French, Americans and occasional individuals of every nationality.

At that time there were no statistics, but Colon was supposed to have 16,000 people, Panama 30,000, with about 35,000 people on the line. This population was of the most varied and cosmopolitan description. There were the governing class of pure Spanish descent; there was the "army" of Indians; there were the numerous French engineers, acountants, contractors and skilled laborers, with intermixture of Russians and Swiss; the railroad organization with its officers, conductors, engineers, principal clerks, all American—and sticking to American ways and methods—with subordinate mechanics of all nations, and with native and Jamaican negro laborers.



View on a Heavy Cut during French Operations.

The mainstay or the working population was the Jamaican negro, whose English was a class by itself, and constituted almost another language. Then there were the French negroes from Martinique and St. Lucia, their women particularly being conspicuous with gorgeous silk turbans, directoire gowns and massive heirloom gold jewelry. An oddity was a body of a thousand savage Africans imported for a year from Africa under contract from the King of Dahomey, and here and there in all kinds of shops, the patient and imperturbable Chinese. The government and general business ran in Spanish, the canal in French and the railroad in English, so that language conditions were of a sufficiently polyglot description.

The common currency was Colombian silver, then relatively stable at its bullion value. The Canal Company carried all of its accounts in francs and on a gold basis, and for a large part of its expenditure, it provided by sale of drafts for the silver necessary to be paid out on the isthmus for wages and current accounts. The railroad under the same circumstances did the same thing, but maintained two separate treasuries and sets of accounts, one for gold and one for silver. The silver outgo was in general greater than the income, and to provide the deficiency the railroad sold its New York drafts. This was handled with comparative ease in the early part of my service, but in course of time the price of silver began to fall, and it was a very uncertain question in advance of any given time as to what you could get in silver for a given gold draft. At first one dollar United States in any form was exchanged for $1.40 in silver; then the amount of silver received gradually increased. This decrease in silver value while uniform in direction was subject to fluctuation from week to week like a declining Wall Street market, subject to reactions and fluctuations, but all in the end on a steady down grade. Various methods were adopted by the railroad in an attempt to equalize standards. One experiment was an endeavor of the railroad to go on a gold basis for its silver employees. The merchants and authorities and laborers all fought this bitterly, and the attempt resulted in the only general strike that occurred during my residence on the isthmus. The railroad went back to the old double standard and peace was restored.

The topography of the isthmus in its broad lines is easily understood. A coastal sea level swamp gradually rises in elevation, and its bordering hills gradually approach until the swamps become a trough rising on each side to a common summit near Culebra. This trough on either side is drained by a river, and the valleys of these rivers, as the lowest elevations, furnish the only available location for both railroad and canal. In consequence the locations are never very far apart and in two instances they cross. This will necessitate as part of the work, a reconstruction of the middle part of the railroad so as to throw it all on one side of the canal.

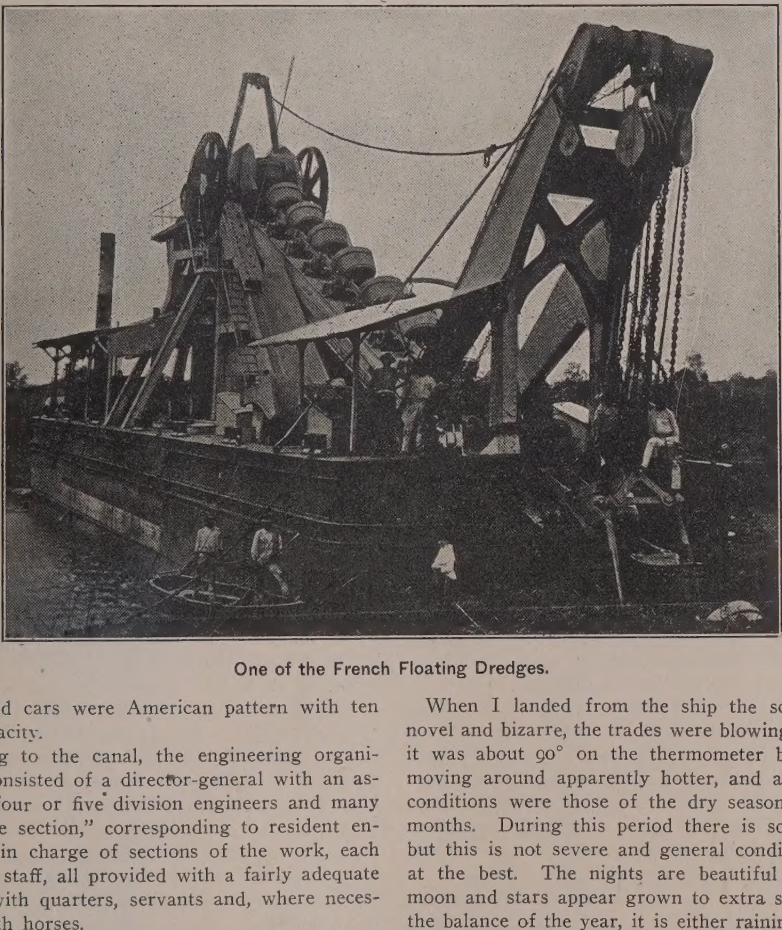
Although the railroad was only 47 miles in length, it was at that time a very active and valuable property, with a gross revenue of $3,800,000 and a force of 4,000 employees. As a rule, traffic was run only during daylight. The highest number of trains I remember was 47 in one day. The road was single track and very crooked. Rails were laid on lignum-vitae cross-ties of generally small size, but of unending durability. These ties had to be bored with an augur before a spike could be driven. The lignum-vitae wears out by attrition of the rail base and spikes, but it will not decay. This line was well ballasted with gravel and generally had a 60-lb. rail, but with English 70-lb. rail on the grades. This was only 4 in. high by ⅞ in. thick in the web, and had to be "bull-dozed" on all but the lightest curves. Maximum grades were 60 ft. to the mile. As to bridges, they were all sorts, many cast iron girders, truss bridges with double sets of diagonals, tension members fastened to cast-iron connections by keys, top cords of many thicknesses of corrugated iron riveted together, and other experiments of fifty years ago. Rolling stock was 5 ft. in gauge, locomotives were American type and build, and cars were American pattern with ten tons capacity.

Coming to the canal, the engineering organization consisted of a director-general with an assistant, four or five division engineers and many "chefs de section," corresponding to resident engineers, in charge of sections of the work, each with his staff, all provided with a fairly adequate salary, with quarters, servants and, where necessary, with horses.

The compensation paid to this canal organization was not officially known to the writer; but he remembers very well the common statement current at the time. The director-general was said to receive $25,000 gold, the division engineers $10,000 to $12,000, and the resident engineers about $5,000. This compensation was practically met and carried with it certain contract stipulations as to leave of absence and payments to be made on completion of a stated service, these stipulations applying also to assistants and to a number of other employees in other departments; all of them included in what was called the classified service, which, in a general way of speaking, included all of the technical and accounting staff that were brought out from France.

The organization as to individual capacity was good. It was extremely cumbersome, bureaucratic and inelastic for a work of construction; it was inefficient from divided responsibility, and official red tape hung up on the general office administration at Paris.

The French came from a highly organized and complex civilization, where every one and everything had its place. They seemed tied down by almost slavish regard for precedents as they knew them, and this characteristic joined to a lack in engineers, contractors, and skilled workmen of that spirit of "get-there" and initiative which has been forced upon the American people in every walk by the energy necessary to create the nation out of a wilderness, accounts for much. The writer expects that in the Americanization of the canal that this spirit will greatly improve the efficiency of the organization, but under no circumstances will we see former efficiency as shown in this country, in any line, continued in an equal degree on isthmus. Rain, mosquitoes, monotony and temperature will sap all but the rarest vigor, and in course of time bring the most aggressive spirit to acquiesence in anything that comes along, and a disposition to do as little as possible.



One of the French Floating Dredges.

When I landed from the ship the scene was novel and bizarre, the trades were blowing briskly, it was about 90° on the thermometer but when moving around apparently hotter, and all of the conditions were those of the dry season of four months. During this period there is some rain, but this is not severe and general conditions are at the best. The nights are beautiful and the moon and stars appear grown to extra size. For the balance of the year, it is either raining or going to rain, or getting over it, the practical point being that no construction can be figured as continuous unless much of it be done in the rain. Much of the work must be done with steam shovels, and the rainfall on their accompanying construction tracks, will be one of the hardest conditions that will have to be met. Their maintenance in an operating condition that will prevent delays in car service to the shovels will be the severest tax placed on the capacity of the canal force.

It would be of little value at the present time to speak of the equipment provided by the French for construction. Some astonishing mistakes were made. Construction locomotives, expected to be handled on rough and crooked tracks, had three drivers on a side rigidly coupled; construction, 70-lb. rail was 5 in. high with a 3¾-in. base; their digging machines were something wonderful in the way of weight, cost and cumbersomeness. The dredges were up to date for that time, and the American Slaven dredges were the leaders of the world of that day.

The canal contracts were divided into large units; two dredging contractors on the Atlantic side, one on the Pacific, Eiffel for all the locks, and three firms for the excavation of the central mass. The general theory on which these contracts were placed was that the separate enterprises involved such enormous expenditures for plant, and would run into such time before the plant could be made productive, that no contracting organization could afford the outlay. With this in mind, the canal company agreed on a price per cubic meter, then authorized the contractor to order the equipment he desired at the canal company's expense, and when this equipment was set up the company paid for the equipment and paid the contractor 10 per cent. on the cost. The company then commenced keeping books against the contractor charging his estimates with a 10 per cent. rental on the delivered cost. This would seem a very extraordinary business proposition in this country and at the present time, but like many apparently unaccountable things it clears up all right when you get the explanation. That explanation comes from the fact that a contractor at that day might have been justified in undertaking the risk of actual handling at unit prices, but if he were well-informed as to the financing that was going on at Paris, he might reasonably foresee that without such protection the financing might play out about the time the contractor had organized his work. As a matter of fact this did happen—pretty nearly.

The lapse of seventeen years since the time I write of has seen vast improvement in the mechanical tools available to contractors and the creation of a large class of labor and skilled labor acquainted with their capacities and use. This will be available for the American canal, but from various reasons, political, distance from their base, undevelopment at their date, and so on, it was not available to the old canal. The American canal will undoubtedly get more efficient results than the old from this cause, coupled with the previously alluded to undoubtedly superior American capacity in handling large construction work and from the very valuable feature of nearness to the States. Another important fact favoring American economy is that the payments are assured and no securities are to be unloaded on the public. The risk from the financial side and the sacrifices made in meeting this feature and the stock market jockeying necessary to float and support the recurring issues of securities were responsible for an enormous amount of waste and indirection in the old company.

As I saw it at the time, the difficulties in this field were insurmountable under the conditions. No personality other than that of De Lesseps could have made the struggle that was made. The basic fact was, at that time and even at this day, the canal enterprise carried out by a private company that would have to go through the usual course of promotion, construction and operation, and then get returns on its money, was an impossible proposition in the sense of being a justifiable investment for private means. Without regard to what the earnings might arrive at in the future the time of construction and the maintenance during the slow growth of traffic to an earning capacity would inevitably swamp any canal enterprise conceived on a commercial basis where capital must have an early dividend.

In this country, the motives of the group of Frenchmen who promoted the Panama canal have always been associated with financial scandal, but I have always thought that the malodorous portions of the canal history were in a large measure forced by circumstances. De Lesseps was the whole canal. He was a man of the highest character, reputation and prestige, and gifted with almost hypnotic influence in persuading and moulding others to his views, which were mainly along the line of magnificence in achievement. He was not an engineer or business man, but a diplomat. He conceived the ancient idea of a Mediterranean and Red Sea canal at Suez, accomplished its construction against diplomatic, engineering and financial opposition, and prior to entrance on the Panama promotion, had demonstrated its commercial success. He succeeded because the physical difficulties in a constructive sense were simple, and the traffic of enormous proportion was in sight. The conditions at Panama were reversed. De Lesseps, successful at Suez, could see nothing but that he could duplicate at Panama what he had already demonstrated at Suez. This belief, profoundly impressed upon a large audience, created the original Panama flotation. But expenses and time strung out, more and more money had to be gotten; the difficulty ever grew greater with each succeeding flotation. If the truth had been confessed, which was not fully known, of the real difficulties, everything hitherto contributed might be lost. And so the campaign went on with increasing holdups from all sides—banker, newspaper and legislator—until the inevitable smash had to come. It is easy to say that all this is wrong, but at the same time it shows a kind of human nature that we see generally duplicated both in individual and corporate actions in other climes than France, and the author of this ruin paid his penalty by death in a madhouse, and was never accused of personally profiting out of the enormous expenditures.

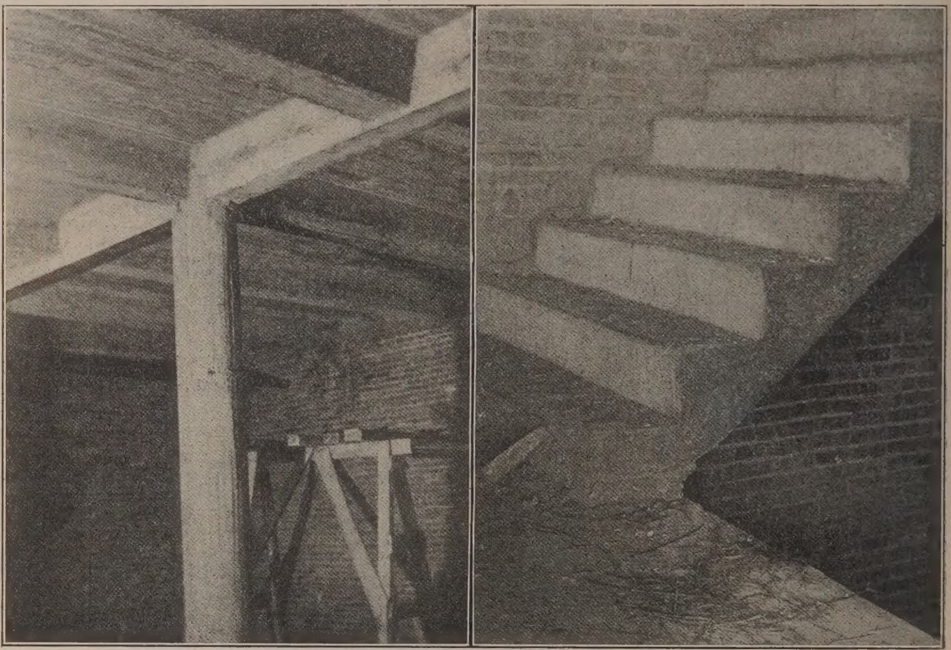
As a final word, we get down to where we all get to at Panama, and that is the consideration of climate. In the course of years the writer has heard opinions ranging all the way from the pessimist's claim of the most deadly climate in the world to the optimistic enthusiasm of a vigorous fresh arrival, wafted by the trade winds to a new job filled with boundless possibilities of fame and "pesetas." The writer was somewhat advised of conditions before arrival, and in his own thought was in a somewhat middle ground, but when he was laid up with a mild attack of fever in less than ten days after arrival and was uncertain as to whether it was really mild or not, the balance swung somewhat toward the pessimistic side. In a subsequent stay of three years, broken by several vacations, the writer had no actual return of fever, but there were many, many very off days when the mental view of other climes appeared more attractive. In his observations, among Americans who were well fed and well cared for, the deaths were surprisingly small. Nearly every one will have the fever after shorter or longer intervals, but most will get over it and be as well as ever, and, in the majority of cases, with no permanent impairment of health, or after constitutional effects. For some reason not understood by the writer, the susceptibility of the French to fever and death was enormously greater than that of our own people, and the true statement in regard to them has been distorted into a general statement applying to all.

The objection to isthmian work to the writer's mind is not so much the positive danger from fever, but the monotonous and sticky atmospheric conditions which produce the tropical lassitude and loss of energy that gives a sort of mental bad taste in the mouth. Its effects upon any given make-up of individual cannot be predicted in advance. Like the gentle dews of heaven, it falls upon the just and unjust with equal impartiality. You escape or suffer, as the case may be, without being able to arrive at the rule by which you do either.

Although in no sense connected with the purpose of the article, a few thoughts regarding the personnel of the canal under American auspices may not be out of the way. To many minds there is a feeling that connection and service on such an epoch-making work as the construction of the Panama Canal, will be of far-reaching value in other and future directions. If it be considered how very many skilled men of all classes will be employed during the long time of the construction of the canal, it appears to the writer's mind that the number would be so great that the simple fact in itself of having been connected with the work will have no practical value as to future employment or prestige. There will assuredly be great rewards in reputation for some, but these cannot be general on the principle that generals are few, but in the nature of things the privates have to be many.

In comparing a given term of service on the canal with a similar term of service at home, the point should be well considered that at home, the service is with friends, with surrounding opportunities and chance for acquaintance in other lines. In the canal service there is only one line of activity to look at, and as the others will have only the same, the scramble for promotion will be acute. If after a certain term of years, the canal employee returns to his old habitat, he will have to commence where he left off when he went away, or worse, and spend a valuable part of his remaining energy in trying to elbow out the fellow who has stepped into his vacated place.

The inference from all of the above is that for each individual there is a point where canal service would be attractive from a business standpoint, provided the offered compensation is sufficient to justify the move, after the foregoing facts are valued in connection with existing earning prospects; and further, from the same business standpoint, no one is justified in taking the risk of canal service without a very much larger compensation than he receives for similar service here, and after determining this point very thoroughly, make sure that what he expects to get is in such shape that he knows what it will be net.


Underside of Floor and Stairway Tested in Rubel Building.

THE BAROMETRIC TUBE CONDENSERS, in the plants under charge of Mr. H. G. Stott, of the Interborough Rapid Transit Co., New York, produce a vacuum of 27.5 in. without a dry-air pump and 29 in. with it.

The Strength of Reinforced Concrete.

A valuable discussion of 202 tests of reinforced concrete beams made by eight different experimenters was given in a paper read before the Western Society of Engineers on March 15 by Mr. T. L. Condron. These beams were all of large size. In order to make a comparative study of the results, Mr. Condron computed the actual ultimate bending moment, M, developed for each test by the weight of the beam and the breaking load, and also the percentage of reinforcement for each beam. This percentage, P, was not obtained in the usual way, but by the formula $P = 100 \times \text{area of bars} \div bd$, where b is the width of the beam and d its depth from the top surface to the bars and not the full depth, h, between the top and bottom surfaces. As beams vary in strength directly as the breadth, b, and the square of the depth, d^2, the basis of this study has been to plot the results of all these tests so that the ordinates would represent the values of $M \div bd^2$, while the abscissas represent the values of P. A diagram of this sort will be found in The Engineering Record of September 10, 1904.

The results of 15 tests with plain reinforcing at Purdue University, as reported by Prof. W. K. Hatt to the American Society for Testing Materials in 1902, were found to lie close to a line, the equation of which is $M \div bd^2 = 275 P + 55$.

Results reported by Prof. G. Lanza, of the Massachusetts Institute of Technology, on 26 tests made with plain steel bars and Ransome twisted bars are very erratic, notwithstanding the fact that all of the beams tested were of the same size and span.

The results reported by Prof. M. A. Howe, of the Rose Polytechnic Institute, were obtained with beams 12 in. wide with depths of 5, 7, 9.5, 10, 14.5, 18, 19 and 21 in. All of the beams were reinforced with corrugated bars, and about half of the number had 0.7 per cent, reinforcing, or the percentage called for by Johnson's formula for average rock concrete. The balance had 0.6 per cent. reinforcing. The theoretical strength called for by Johnson's formula is $M \div bd^2 = 450 P + 55$.

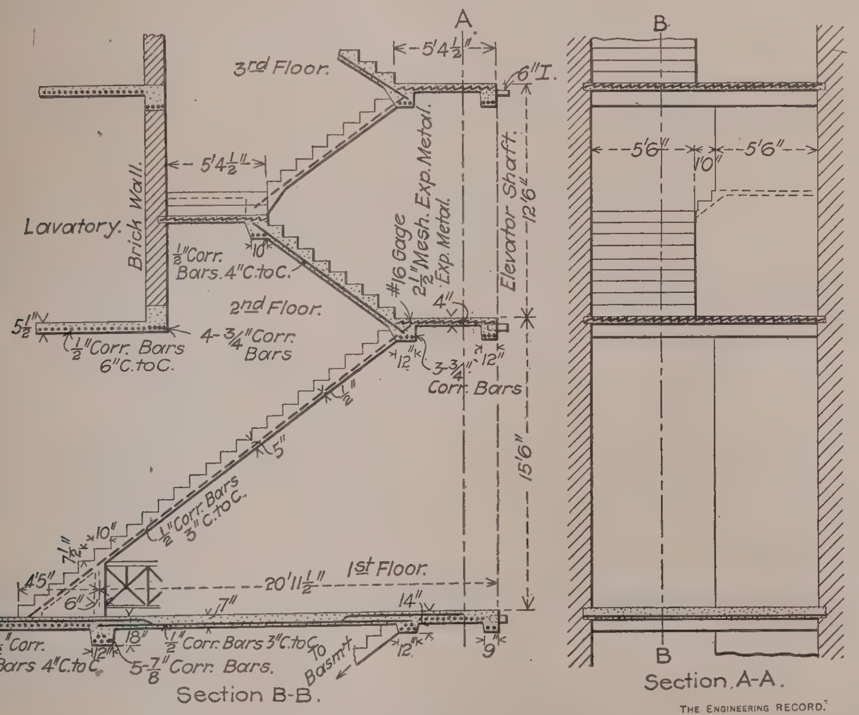
The results reported by Prof. A. N. Talbot, of the University of Illinois, were described in The Engineering Record of Aug. 11, 1904. His beams were all of the same size, 12 in. wide by

13½ in. deep, or 12 in. deep to the plane of the reinforcing, and tested on a 14-ft. span. These tests are of especial interest as various percentages of reinforcing and different forms of bars were used. It was the study of these tests that first led the writer to observe that straight lines would pass through the results of tests for each kind of reinforcing and that these lines would intersect in a point representing the strength of a plain concrete beam. The equation, $M \div bd^2 = mP + n$, becomes, for a plain beam, $M \div bd^2 = n$, for d becomes a and $P = 0$. The writer found the value of n from three tests of plain beams to be approximately 55. The three plain beams were reported by Prof. Lanza, Prof. Talbot and Mr. J. J. Harding, of the C., M. & St. P. Ry.

Comparison of the Actual Ultimate Strengths of Beams Tested, with the Theoretical Ultimate Strength (1.00) determined for each by the Formula $x = [(M \div bd^2) - 55] \div 450\ P$.

Kind of bars used		Plain		Spcl. Plain		Thacher		Twisted		Corrugated		Kahn		Strength of Concrete
Average elastic limits of bars ..		37,700		75,000		36,900		67,000		60,100		34,000		Concrete
		No.	x	No.	x	No.	x	No.	x	No.	x	No.	x	in Comp.
University of Illinois	Min.	..	0.57	..	..	..	0.64	..	..	..	0.77	..	0.61	....
	Ave.	5	0.61	..	..	2	0.68	..	*	6	0.97	4	0.67	2030
	Max.	..	..	..	..	..	..	..	..	..	..	..	..	....
Mass. Institute of Technology .	Min.	..	0.44	..	..	..	..	..	†0.57	..	..	..	..	
	Ave.	5	0.63	..	..	..	..	13	†0.99	..	..	..	..	Not rptd.
	Max.	..	..	..	..	..	..	..	..	..	..	..	..	....
Purdue University	Min.	..	‡0.58	..	..	..	..	..	..	..	..	..	..	2575
	Ave.	12	‡0.64	..	..	..	..	..	..	..	..	..	..	2730
	Max.	..	..	..	..	..	..	..	..	..	..	..	..	2880
University of Pennsylvania ...	Min.	..	0.50	..	..	..	0.55	..	0.48	..	0.80	..		1360
	Ave.	6	0.65	..	..	6	0.72	5	0.63	6	0.96	..	..	1710
	Max.	..	..	..	..	..	..	..	..	..	..	..	..	2500
Rose Polytechnic Institute	Min.	..	..	..	..	..	..	..	..	..	0.82	..	..	....
	Ave.	..	..	..	..	..	..	..	..	18	1.06	..	..	Not rptd.
	Max.	..	..	..	..	..	..	..	..	..	..	..	..	....
University of Wisconsin	Min.	..	..	..	0.76	..	0.84	..	1.11	...	1.18	..	..	2500
	Ave.	..	..	19	0.99	4	0.87	4	1.24	4	1.22	..	..	2913
	Max.	..	..	..	..	..	..	..	..	..	..	..	..	4250
Chi., Milwaukee & St. Paul Ry.	Min.	..	..	..	..	..	..	..	0.67	..	0.96	..	..	....
	Ave.	..	..	..	..	..	..	8	1.26	6	1.40	..	..	Not rptd.
	Max.	..	..	..	..	..	..	..	...	..	..	..	..	....
Boston Transit Commission ...	Min.	..	0.81	..	..	..	0.86	..	0.77	..	1.06	..	..	2840
	Ave.	12	0.98	..	..	2	0.93	8	1.30	32	§1.43	..	..	3930
	Max.	..	..	..	..	..	..	..	..	..	..	...	..	4960
No. of tests and gen. aver. ...	....	40	0.74	19	0.99	14	0.78	38	1.09	72	1.24	4	0.67	

*One test only reported with twisted bars. The result of this test (1.45) is inconsistent with all of the other tests.
†All tests with more than 2% reinforcing omitted. If 7 tests with over 2% are included, the average becomes 0.81.
‡Two tests of cinder concrete omitted. §Neglecting 12 tests with bars in compression as well as tension.



Reinforced Concrete Stairway in Rubel Building.

The results reported by Prof. F. E. Turneaure, of the University of Wisconsin, were given in The Engineering Record of Sept. 3, 1904. His tests were made upon small beams, 6x6 in. and 5-ft. spans. The percentage of reinforcing was not varied for each type of bar used. Two unusual features of these tests were that the beams were kept under water until tested, and that the plain bars used were of special steel, having an elastic limit of 75,000 lb. per square inch, or about double that of ordinary structural steel bars. Also the compressive strength of his concrete was unusually great, testing above 4,000 lb. per square inch. It is interesting to note that while the special plain bars had an elastic strength 27 per cent. greater than the corrugated bars, 3 per cent. greater than the twisted bars and 67 per cent. greater than Thacher bars, they did not develop as much strength as the two former and but little more than the last named, showing that even for static tests, it is necessary to have some mechanical bond between the concrete and the steel in order to take advantage of high elastic steel.

The results reported by Prof. Edgar Marburg, of the University of Pennsylvania, were given in The Engineering Record of July 9, 1904. His tests were made on beams of uniform size, 8x8 in. and on spans of 5 and 8 ft.

Results reported by Mr. J. J. Harding of the tests made by the C., M. & St. P. Ry. are quite erratic, but generally owing to superior quality of concrete, higher results were obtained than in most of the other tests referred to above, but they agree very well with the tests of the Boston Transit Commission.

The results of the very extensive series of tests made by the Boston Transit Commission are described in the 1904 report of the Commission. As in the tests at the University of Wisconsin and by the C., M. & St. P. Ry. Co. a very strong concrete was used, testing above 4,000 lb. per square inch in compression. The elastic limit of plain bars is 35,000 to 45,000 lb. The Thacher bars gave 40,760 lb. elastic limit, the corrugated bars 60,100 lb. and the twisted bars 67,600 and 69,700 lb.

Of those tests 72 referred to beams in which corrugated bars were used. The following is a brief capitulation of these results relative to the straight line formula, $M = (450\ P + 55)\ bd^2$: 80 per cent. are above the formula, 20 per cent. are below the formula, 8 per cent. are under 10 per cent. below the formula, and the lowest is 22 per cent. below the formula.

The tests reported in which twisted bars were used were 38 in number, and a similar capitulation with reference to the same straight line formula, is as follows: 60 per cent. are above the formula, 40 per cent. are below the formula, 37 per cent. are under 10 per cent below the formula, 29 per cent. are under 20 per cent. below the formula, and the lowest is 52 per cent. below the formula.

There were 40 tests reported in which plain structural steel bars were used. All but two of these results fall below the straight line equation, $M = (450\ P + 55)\ bd^2$, but they lie reasonably close to the line, $M = (275\ P + 55)\ bd^2$, which equation is equivalent to 39 per cent. less strength than the former, or the former is 64 per cent. stronger than the latter. The tests of the Boston Transit Commission are practically 45 per cent. above the other tests, owing to the stronger concrete used.

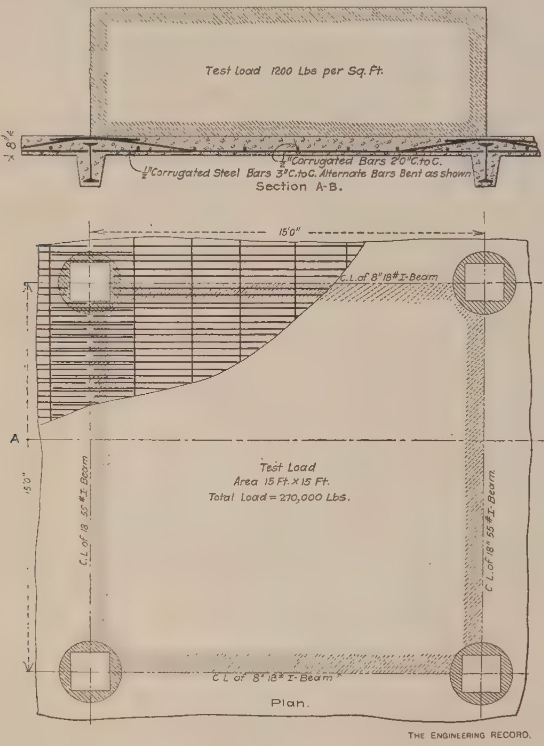
Mr. Condron has adopted the straight line equation, $M \div bd^2 = mP + 55$. As a basis of the study of all the beam tests that have come to his attention, and in making comparison, he has transposed all the known terms to the left side of the equation, thus: $(M \div bd^2 - 55) \div P = m$, and he has determined the value of m, for each beam tested. Therefore, for purposes of comparison, the ratio of the value of m for each test to 450, has been determined, and these ratios are given in the tables. In determining the ratios in the case of the tests with Kahn bars, due allowance has been made for the fact that these bars had their section reduced by shearing inside of the region of maximum moment, thus reducing the area and the percentage of reinforcing from that given in Prof. Talbot's report.

It would seem that a sufficient number of rectangular beam tests has been made from which to draw valuable conclusions as to the probable behavior of such beams in practice. From Prof. Turneaure's tests at the University of Wisconsin it is learned that when the tensile stress in the steel reinforcing exceeds 15,000 lb. per square inch, fine hair cracks begin to appear in the concrete. These cracks, if present, are microscopical until the steel is stressed to about 15,000 lb. per square inch or until the stretch is equal to 5/10,000 of its length, or five times more stretch than plain concrete will withstand without complete rupture. Failure, however, does not occur until the stress in the bars has passed the elastic limit.

From all of the tests, Mr. Condron believes that reinforced concrete beams have more of the characteristics of steel than of plain concrete beams. They deflect under loads and recover when the loads are removed, and before failure occurs there is ample warning given by the appearance of large cracks in the concrete indicating that the steel is approaching its elastic limit.

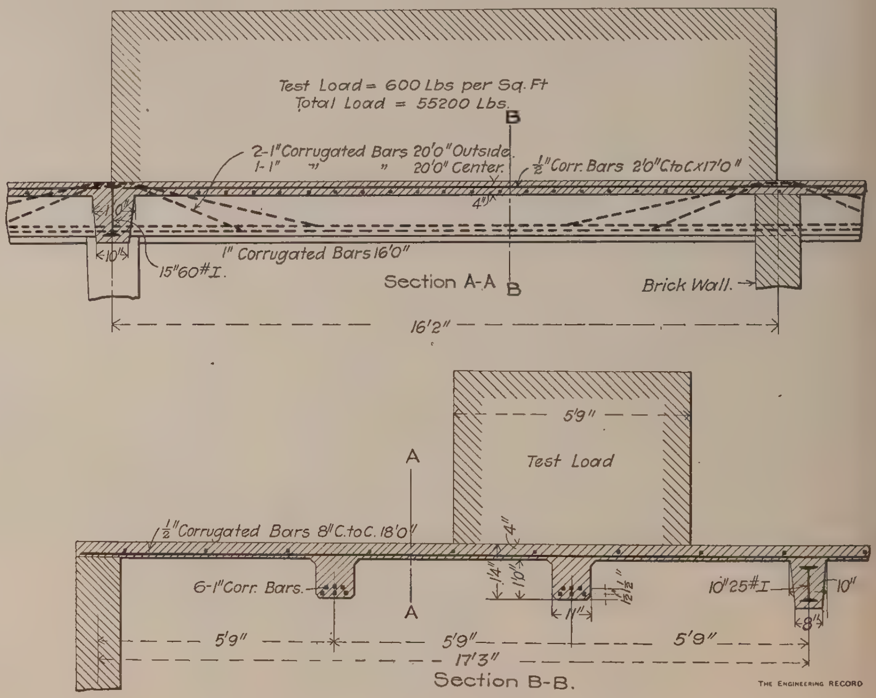
Likewise, it is proved to the satisfaction of Mr. Condron that the ultimate strength of such beams is coincident with or a little above the point when the stress in the steel reinforcement passes its elastic limit. If high elastic steel is used it is necessary to have a positive bond between the steel and the concrete to develop this strength, as the adhesion of concrete to plain steel is not sufficient. (See results of Prof. Turneaure's tests with plain rods of 75,000-lb. elastic strength.)

It is also proved to Mr. Condron's satisfaction that the strength of the beam is a direct function of the strength of the concrete in the beam. The Boston Transit Commission obtained nearly 50 per cent. higher results with concrete of 4,000 lb. compressive strength than the other experimentors obtained with concrete of from 2,000 to 3,000 lb. compressive strength. Apparently if the concrete is of uniform strength the beams will vary in strength directly as the strength of the bars, depending upon the area and elastic limit of such bars, and the bond between bars and the concrete. For average rock concrete of the composition of one of cement, three of sand and six of broken stone, one inch and under in size, dust screened out, it is safe to use the following formula where P is not less than 0.5 nor more than 1.25 per cent.; ultimate moment in inch-lb. $M = (n P + 55) bd^2$. For high elastic bars with positive bond to concrete, $n = 450$. For plain bars of ordinary structural steel, $n = 275$.


Test Load 1200 Lbs per Sq. Ft.
8¼"
½" Corrugated Bars 2'0" C. to C.
½" Corrugated Steel Bars 3" C. to C. Alternate Bars Bent as shown
Section A-B.
15'0"
C. L. of 8" 18# I-Beam
A
B
15'0"
Test Load
Area 15 Ft. × 15 Ft.
Total Load = 270,000 Lbs.
C. L. of 18" 55# I-Beam
C. L. of 18" 55# I-Beam
C. L. of 8" 18# I-Beam
Plan.

THE ENGINEERING RECORD.

Floor of North American Cold Storage Building.



THE ENGINEERING RECORD

Sections of Test Floor in Rubel Building, Chicago.

It generally will be found economical to use between 0.7 per cent. and 0.9 per cent. of reinforcing metal for average rock concrete. For extra strong concrete of about 1 of cement, 2 of sand and 4 of broken stone, the percentage of reinforcing may be increased to 1.25 per cent., but more than this will not be economical, at the usual costs of materials in this part of the country. Reinforcing of 1.0 per cent. is equivalent to approximately 120 lb. of steel per yard of concrete, or 100 lb. of steel per cubic yard of concrete is equivalent to 0.83 per cent. of reinforcing.

The relation which scientifically made tests bears to ordinary working conditions is of great importance. It is practically impossible to load structures in practice so that the conditions are as severe as in carefully made laboratory tests. Therefore, in practice structures are almost never subjected to such stresses as they are calculated and designed to carry. The floors of buildings are built in continuous sections, and it is practically impossible to cover an entire floor with a dense maximum load. Culverts are designed to carry enormous earth pressures, but in practice earth will arch and the load be thereby reduced on the roof of a culvert. In bridge design we provide for enormous impact effect and endeavor to impose conditions even more severe than can result from rapidly moving trains. Two reinforced concrete floors were recently tested in Mr. Condron's presence, which will illustrate this point and show also the great strength which such floors develop.

One of the illustrations shows a plan and section of floors put in the North American Cold Storage Co.'s building at Kinzie St. and the Chicago River. This building has 16 stories, and all the floors are of this design, put in by Mr. A. C. Warren. Two sections of this floor were tested to what was figured to be very nearly the ultimate strength, 1,200 lb. per square foot. A total of deflection of ¼ in., including the deflection of the supporting beams, was measured. The concrete showed no signs of cracks during or after the test. The test was fairly and honestly made, and the results are little less than astonishing. Such a test is quite different from a laboratory test of a beam set on knife edges and free from all external assistance.

The second floor tested is also illustrated. A panel of this floor was tested to 600 lb. per square foot, and there was no appreciable deflection nor signs of cracks. It was designed for 200 lb. per square foot of live load. These floors are in the Rubel Building, Jackson Boulevard and Green St., and were put in by the R. & S. Sollitt Co.

Two of the illustrations show reinforced concrete stairways in the same building. There are two sets of these stairs running from the basement to the roof of the eighth floor. One flight and two landings were loaded with 240 lb. per square foot over all, and the total deflection was 1/16 in. The architect for both of the above buildings is Mr. Frank B. Abbott.

One-Half the Capacity of a large electric lighting station in this country, according to Mr. J. W. Lieb, is used not over 500 hr. of the whole year, one-quarter of it but 75 hr. and 10 per cent. but 25 hr.

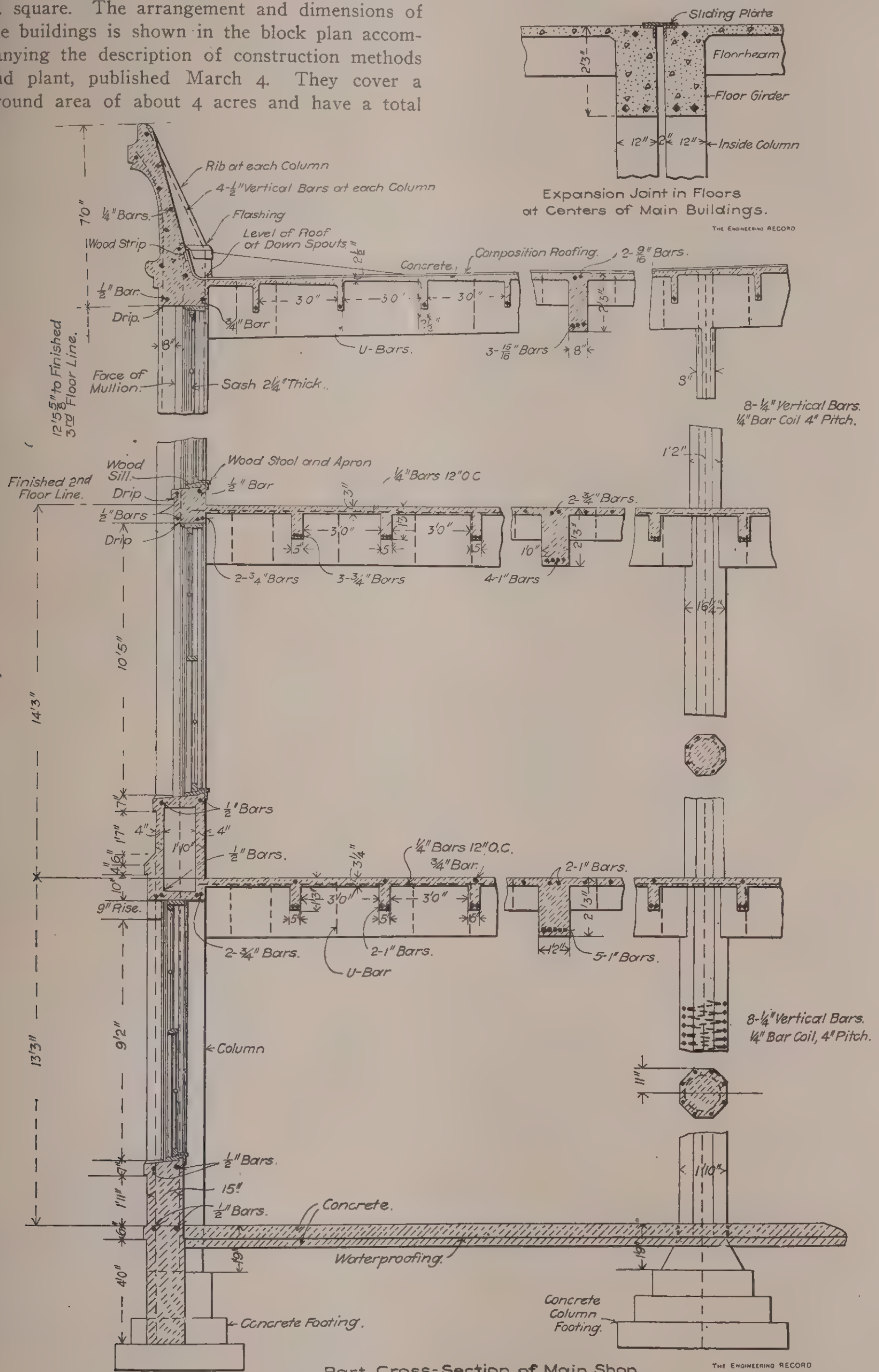
Value of Tail Rods on Engines.

The value of tail rods on engines has been open to study under interesting circumstances in the power station of the Camden & Suburban Railway Co. The equipment includes two cross-compound condensing Corliss engines, built by the Pennsylvania Iron Works Co., with cylinder dimensions 30.5 and 52x42 in. The engines are duplicates of each other, except that one has a tail rod on both high and low-pressure pistons, while the other has not. The experience has been that the engine with the tail rods has cost nothing for maintenance during the two years it has been in service while the other engine has worn out two sets of bull rings during its three years of service. It is stated further that it has been possible to work the former engine at about 10 per cent. greater capacity than that without the rods. The results are attributed to the fact that very substantial rods have been used, in connection with proper support. The success depends, in the opinion of the engineers of the company, on having a through rod from crosshead to tail bearing of sufficient strength and properly bowed upward, so that when the weight of the piston is added the deflection due to this weight gives a fair bearing to the piston on the lower part of the cylinder.

High-Voltage, Direct-Current Transmission at 57,600 volts from a water power plant at Moutiers, France, to Lyons, a distance of 112 miles, is being caried out by the Compagnie de l'Industrie Electrique, Geneva, according to the "Zeitschrift für Elektrotechnik." The current is to be supplied from four generating units, each consisting of a turbine driving two series dynamos designed for 75 amperes at 7,200 volts, the aggregate capacity of the station being, therefore, 4,320 kw. It is expected that the absence of induction and resonance effects will permit the use of a cable normally designed for 50,000 volts alternating. Part of the current supply is to be transformed for railway use and the rest is to be converted into three-phase current. It is an interesting fact also that the middle point of the generating plant and that of the motor plant at Lyons is earthed.

The Shops of the United Shoe Machinery Co., Beverly, Mass.

The new plant at Beverly, near Boston, Mass., of the United Shoe Machinery Company, of Boston, is intended for the manufacture of light machinery. It replaces several detached plants and at present consists of five principal buildings covering most of the space, except what is needed for light and air courts, in an area about 525 ft. square. The arrangement and dimensions of the buildings is shown in the block plan accompanying the description of construction methods and plant, published March 4. They cover a ground area of about 4 acres and have a total floor area of about 18 acres. Their construction involves a total of about 160,000 cu. yds. of excavation, 48,000 cu. yds. of fill, 40,000 yds. of concrete and 2,000,000 lbs. of steel reinforcement. The estimated cost of the completed buildings exclusive of land and interior equipment is about $1,000,000.



Expansion Joint in Floors at Centers of Main Buildings.

Part Cross-Section of Main Shop.

General Type of Construction for Main Buildings.

All of the buildings are constructed entirely of concrete except that the roofs of the foundry and forge shop are supported by steel beams and trusses. Wherever reinforcement is necessary, it is made with the Ransome system of twisted steel bars which are proportioned to take all tensile stresses. The superstructure concrete was all mixed 1:2:4 with screened gravel from ¼ to 1 in. in diameter. Lehigh and Atlas brands of Portland cement were used and the concrete was mixed very wet. Care was taken to maintain the work continuously until finished for given sections of the building, so that the beams, girders, floor panels and other elements of construction are monolithic. Samples were taken daily from the concrete mixers and 6-in. test cubes were made from it and tested when seven days old. These showed in all cases a satisfactory strength corresponding with the cement tests.

All foundations have offset footings built in the open trenches and seated on the leveled surface of hard clay, in most cases below the ground water line. The footings were made with 1:3:7½ concrete without reinforcement rods. The exterior walls of the main buildings are about 70 per cent. window space and consist almost entirely of the wall columns or piers, girders or belt courses and cornice, so that above the sills of the first-floor windows, there is practically no wall surface proper, and the structures are supported wholly on the columns. These are seated directly on the foundation piers and are independent of the first-story floors which were constructed after the columns. All partitions are made of concrete reinforced with vertical and horizontal rods of twisted steel usually ¼ in. square and 6 in. apart. The partitions are from 3 to 6 in. in thickness.

The principal buildings are the two machine shops, 61 ft. 10 in. wide, and 531 ft. 10 in. long over all, and four stories in height. The storage building corresponds to them except that the length is only 281 ft. 10 in., although it is connected by a one-story lavatory building of the same width with the forge shop, which is also of a uniform width, and the three together occupy the same ground area as the machine shops. In the two larger buildings there are twenty-six panels substantially alike, except for the arrangement of the floor in the end panels and for minor differences due to stair and elevator shafts, etc.

The columns are arranged in twenty-seven transverse and four longitudinal rows 30 ft. apart on centers. The wall columns are approximately rectangular in cross section and those on one side of the building are made hollow to contain hot-air flues for the heating and ventilating system. An intake shaft about 6 ft. square is provided on one side of the building and through it air is drawn from above the roof level and after passing through the heating apparatus is distributed through the buildings by way of the column ducts, and in some cases through ceiling ducts. The exterior columns or wall piers are each reinforced by four ⅜-in., full-length vertical rods which are continued through the parapet above the roof. These are tied diagonally by ¼-in. horizontal bars 2 ft. apart vertically, and curved, flat, galvanized horizontal steel strips are embedded in the piers to afford anchorages for the wooden window frames. Each pier, or wall column, has a 5x5-ft. foundation area and sustains not only the direct floor load, but the wall panel below the sills of the first-story windows which reaches to a grade line 6 in. below the surface of the first floor and is treated as a self-sustaining girder bonded into the piers and reinforced with a pair of ½-in. horizontal bars near the upper and lower edges.

The interior columns are all practically duplicates and have an octagonal cross-section with diameters of 8 in., 14 in., 18¼ in. and 22 in. in the fourth, third, second and first floors, respectively. Each of them is reinforced by eight vertical ¼-in bars in the angles close to the surface of the concrete, and by an interior coil of ¼-in. twisted steel with a 4-in. pitch which is inscribed within the vertical rods. The vertical rods in both wall and interior columns are made in one-story lengths with their ends lapped 12 in. and enclosed in sleeves 12 in. long made with close coils of ⅛ x ¼-in. steel. At the floor level of each story the upper and lower sections of the columns are united by a solid concrete block seated on the top of the lower section and projecting somewhat beyond it to afford abundant connections for the floor beams and girders with which it is made integral. The upper section of the column is started on the surface of this block and both sections of the column are separate from it, but are bonded through it by means of their continuous vertical rods.

The floors are made, as indicated in the general plan, with transverse girders 20 ft. apart and longitudinal beams 3 ft. apart in the clear and 20 ft. long, which have their center points conected by a narrow beam or stiffening rib which is designed to give them lateral rigidity without being calculated to carry vertical loads. The floor beams and girders are reinforced by horizontal bars in both the upper and lower edges, and the floor slabs are reinforced by ¼-in. bars 12 in. apart, just above the lower surface. The reinforcement rods in both beams, girders and floor slabs project beyond the edges of the panels so as to bond different portions of the concrete together. In the end panels there are two longitudinal girders, between which the floor beams run transversely. Between these girders and the side walls there are no floor beams, and the 30-ft. floor slab is reinforced by crossed tiers of ¾-in. bars parallel to the diagonals.

The roof construction corresponds to the floors, except in the dimensions of the beams, girders and slabs which are lighter in proportion to the live load, which is only 75 lb. per square foot, while that of the third and fourth floors is 200 lb., and the second floor 250 lb. Between the first and second stories the outer wall is 22 in. thick over all, and contains an air space 14 in. wide. At this place, as in the other belt courses, the upper edges of the wall are bevelled to make window sills, and care is taken to undercut the lower edges of all horizontal projections so as to form drips.

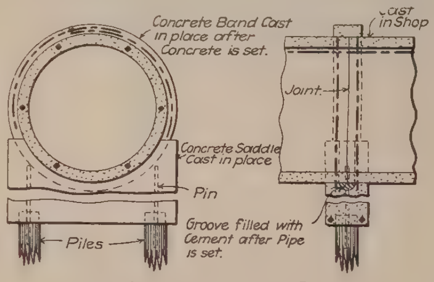
The floors have a smoothly troweled wearing surface, and the roof is water-proofed with several thicknesses of felt and tar covered with gravel. The felt is flashed up 12 in. on all sides over the inclined inner face of the parapet wall about 6 ft. high. This wall is continuous around the entire building and is stiffened by inside buttresses at panel points. The outer surface is moulded and it is reinforced by the curved column bars in vertical planes and by a number of horizontal 14-in. bars continuously spliced.

The Ransome system of construction is used throughout the building, and its standard details correspond in general to those of the Kelly factory at Greensburg, Pa., and other buildings of the same type that have from time to time been illustrated in The Engineering Record. Special requirements in this building call for some new details, among which is the roof girder designed to carry the skylight curb. In order to provide a roof surface unobstructed for drainage, and to secure the maximum clearance below the ceiling and allow for transverse ventilation ducts, these girders were made as shallow as possible, and are reinforced with steel rods intended to take compression as well as tension strains. Both upper and lower sets of rods are connected by a continuous coil of ¼-in. rod with a 12-in. pitch, which virtually forms zigzag diagonals between the top and bottom chords, all connected and held in place by the concrete.

In the end panels of the building two sides of the floor are supported directly on the curtain wall instead of being carried by beams and girders, and here also the walls are reinforced with compression members in the upper edges which, with the tension members, virtually form top and bottom chords of the concrete beams, as indicated in the detailed section.

In order to provide fastenings for shafting, machinery and other purposes and the ceilings throughout the buildings, anchor-bolts were built into all transverse floor and roof girders 3 ft. apart on centers, and in the middle of each floor and roof panel there is also a transverse line of bolts with alternate spacing of 1 ft. and 6 ft. The bolts supported by the girders have their upper ends bent at right angles and the nuts on their lower ends engage cast-iron saddles that clamp against pairs of small angles with wood fillers, as shown in the cross-section. This affords a very solid and satisfactory connection for the different mechanical purposes required. In the floor panels the bolts have simple heads or nuts on the upper end which engage washer plates countersunk in the upper surface of the slab. Where the slab is thick the washers are flat, but in thin slabs the washers have U-shaped cross-sections with the upper surfaces flush with the floor.

The unusual length of these buildings made is necessary to provide for the expansion and contraction of the concrete which, between extremes of temperature, has a calculated total movement of 2 in. To allow for this an open joint 2 in. wide is made in a transverse plane through the walls, roof and floors at the center of each long building. Each half of the building is entirely independent and has no connection across the joint, except through the sliding cover-plates which protect it. The opening is made through the centers of the wall columns and at this point the transverse girders are made double with a 2-in. space between them, and their ends are narrowed to the width of the column face and are bonded to it by extending the horizontal reinforcement rods through the whole width of the column, as indicated in the detail. The inner and outer faces of the opening through the column are covered by 6-in. vertical wooden strips seated in grooves 8 in. wide and maintained in position by horizontal through-bolts. The adjacent upper edges of the transverse girder are protected by small angles, one of which is countersunk-riveted to a bevelled steel apron plate which rests on the other angle and slides freely on its upper surface.


Concrete Band Cast in place after Concrete is set.
Cast in Shop
Joint.
Concrete Saddle Cast in place
Pin
Piles
Groove filled with Cement after Pipe is set.

Reinforced Concrete Sewer.

The Engineering Record

In the roof there are transverse ridges across the building on the faces of each joint which rise a few inches above the general surface and have anchor-bolted to them galvanized-iron bent-plates which form aprons and traps to prevent a serious escape of warm air through the open crack and to exclude wind and rain. Any melted snow which penetrates this joint is caught in the gutter formed by one piece and discharged through it to the drainage system.

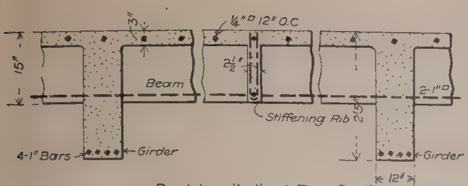
Standard concrete partitions 4 in. thick are reinforced with ¼-in. vertical bars 3 ft. apart on centers which are staggered on the center line so as to be set ½ in. clear of the face of alternating sides. To the inner sides of these bars are wired ¼-in. horizontal bars 12 ft. apart, which are staggered on opposite sides of the partition. There are also two ¼-in. vertical bars on each side of all the openings, and one ¼-in. bar in each corner and one ½-in. horizontal bar over each doorway. The vertical bars are made to project into floor and ceiling so as to form dowels securing the partition in position. The stairs are made with reinforced string pieces on which are seated the steps, which are solid pieces with triangular cross-sections cast in moulds and put in position after the strings had been built. Each step is reinforced with three full-length ½-in. horizontal bars, one at each angle, and is covered with a wooden tread projecting slightly beyond the rise and secured by countersunk screws engaging open plugs in the concrete.

The lavatories between the machine shops are each of them six stories high on one side of the center coridor and five stories high on the opposite side of the same corridor, the roof, first, second, third and upper floors being at the same level on both sides. The basement is occupied by a fan chamber from which rectangular concrete horizontal ducts are carried below the surface of the ground to distribute the hot air to the different parts of the main buildings. At the ground level an open corridor passes through the first story, forming an unobstructed road for wagons between the machine shops. The basement is principally devoted to the heating and ventilating apparatus. The first floor has rooms about 36 ft. wide on each side of the open corridor, which are subdivided and used for tool rooms, wash rooms, locker rooms and toilet rooms, one of each in each row. The upper floors are all similarly arranged, and on each there is provided a large central locker room, beyond which, in the extremity of the wing, is the washer room with rows of small iron sinks movably supported on cast-iron frames so that each one can be separately removed and reversed. There is also a row of shower baths in the same room. In the opposite end of the building there is a toilet room with a tool room on each side of it. The upper story is lighted by skylights occupying about 25 per cent. of the roof area, and about 30 per cent. of the area of the wall is occupied by windows. This proportion leaves a considerably larger amount of concrete wall surface than there is in the main buildings, and it is built with reinforced concrete integral with the wall piers. Otherwise the construction of these buildings and the beams, columns and floors correspond with the main buildings. Concrete was mixed in a main central plant equipped with a No. 4 Ransome mixer of a capacity of 200 cu. yd. per day, which easily delivered all the concrete that could be handled by the excellent distributing system of longitudinal track and transverse Lidgerwood traveling cableway, which deposited the concrete where needed for the main buildings. One No. 3 Smith and two portable No. 3 Ransome mixers direct-connected to independent engines, were used at different parts of the work as needed for auxiliaries. Portable Ransome mixers were also employed and proved especially commendable for capacity, ease in handling and thorough mixing qualities.

Mr. F. M. Andrews, Dayton, Ohio, is the architect of the building, and Mr. Ernest L. Ransome, New York, is the constructing engineer for the concrete construction. The Fosburgh Co., Boston, are the general contractors.

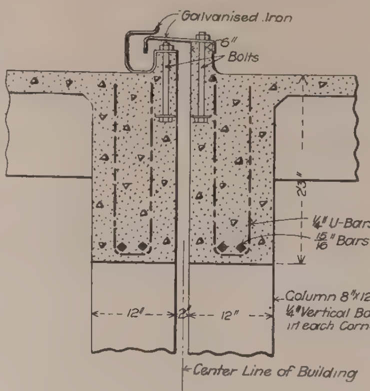
(To be continued.)

A Power-Gas Distribution Scheme designed to supply cheap power gas of an equivalent of 15,000 h.p. over an area of 120 square miles is on the point of completion by the South Staffordshire Mond Gas Co., England. As such a distribution of producer gas means the handling of large volumes, it will be of interest to state that according to Mr. Dugald Clerk in his recent lectures on internal combustion engines before the Society of Arts, of London, it has been found that the blowing plant at the Mond Company's works could transmit 1,500,000 cu. ft. of air per hour through 5 miles of mains with a pressure of 10 lb. per square inch at the station, and that if gas were transmitted at the same rate, it would be equivalent to a supply of 15,000 h.p. Mr. Clerk mentioned the fact that if the Mond producer is not worked at too great a heat, ammonia is formed that is not again decomposed. In keeping down the heat by the introduction of a much larger volume of steam than is required for the chemical reaction, as much as 2½ tons of steam, he said, is used per ton of fuel burnt.



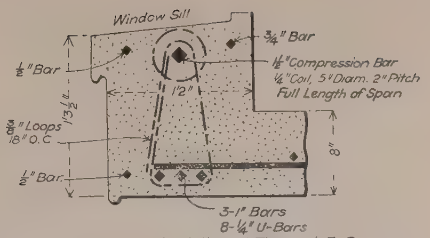
Part Longitudinal Floor Section.

THE ENGINEERING RECORD



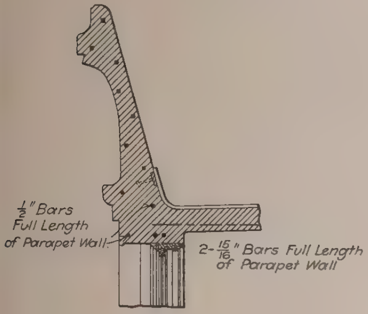
Expansion Joint in Roof

THE ENGINEERING RECORD.

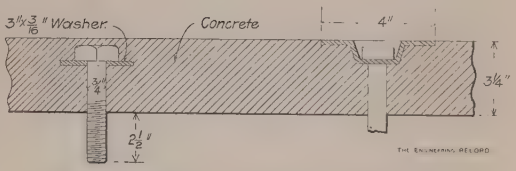


Section through Wall and Floor at Z-Z in Corner Panels of Main Buildings. See First Floor Plan

THE ENGINEERING RECORD

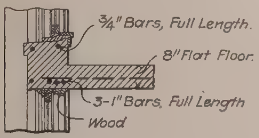

½" Bars Full Length of Parapet Wall
2-15/16" Bars Full Length of Parapet Wall

Section through Parapet Wall

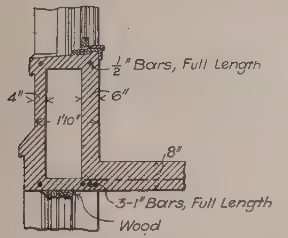


Hanger Connection in Floor Slab. Main Shop

THE ENGINEERING RECORD

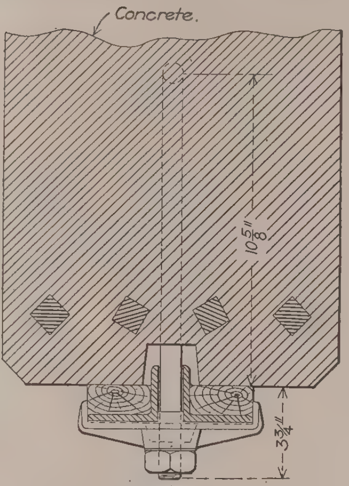


Section through Curtain Wall at Second and Third Floor.



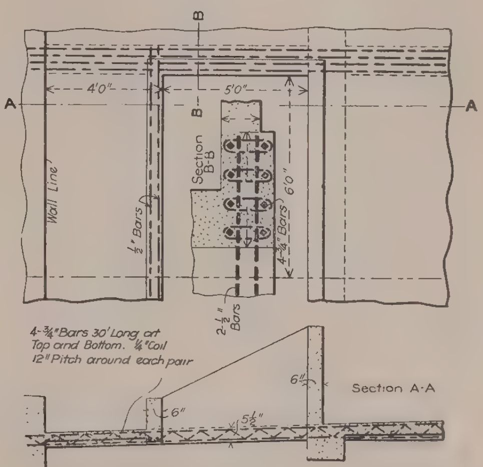
Section through Curtain Wall at First Floor.

THE ENGINEERING RECORD.



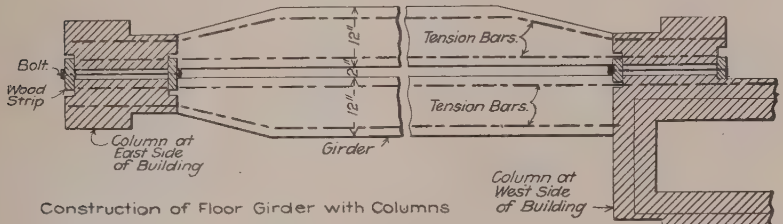
Hanger Connection in Floor Girder. Main Shop.

THE ENGINEERING RECORD.



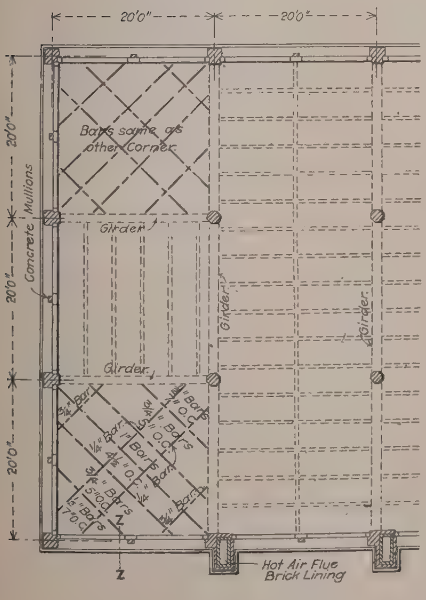
Skylight Framing

THE ENGINEERING RECORD

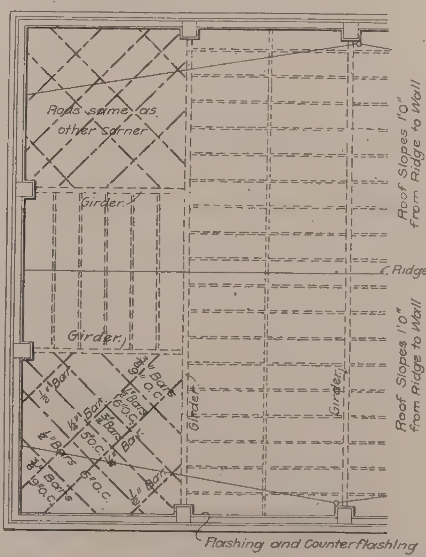

12"
Tension Bars.
Bolt
Wood Strip
2"
12"
Tension Bars.
Column at East Side of Building
Girder
Column at West Side of Building

Construction of Floor Girder with Columns

THE ENGINEERING RECORD

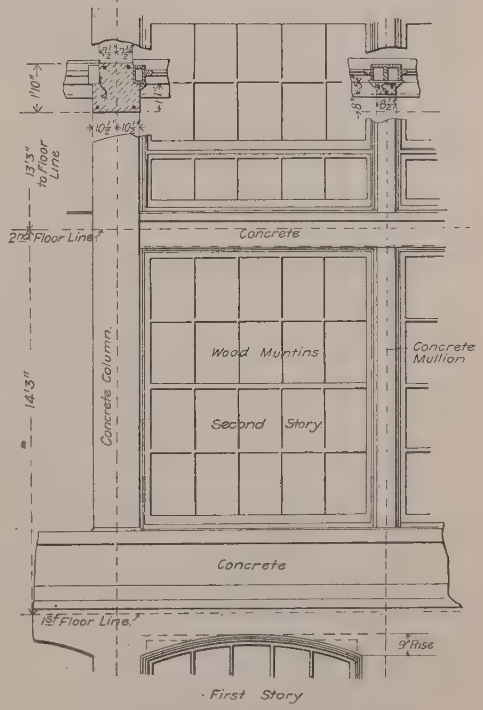


Part First Floor Plan.


Rods same as other Corner
Girder
Roof Slopes 1'0" from Ridge to Wall
Ridge
Girder
Girder
Girder
Roof Slopes 1'0" from Ridge to Wall
¼" Bars
5" O.C.
Bar
Flashing and Counterflashing

Part Roof Plan

THE ENGINEERING RECORD



Windows and Wall Framing in Main Shop.

THE ENGINEERING RECORD

SPECIAL DETAILS, FRONT WALL AND FLOOR SYSTEMS IN MAIN BUILDINGS. UNITED SHOE MACHINERY COMPANY'S SHOPS.

Engineering Features of the New England Conservatory of Music, Boston.

By Howard S. Knowlton.

Among the later buildings typical of the trend of intellectual and educational progress in Boston is the new home of the New England Conservatory of Music. From the standpoint of its mechanical and electrical equipment it is of considerable interest in respect to the requirements of the heating, ventilating, lighting and general power plant service. When the needs of the large number of students (about 1,500) in reference to instrumental and vocal practice under favorable conditions of isolation and physical comfort are considered, the importance of the work of the engineer and the architect begins to be realized. In the organ courses alone the equipment available includes thirteen pipe organs in use in the Conservatory.

The new Conservatory Building is located in the art and musical center of Boston, on Huntington Ave. at the corner of Gainsborough St., extending in the rear to St. Botolph St. The main entrance is on Huntington Ave., but there are also entrances on the other two adjoining streets. The building is three stories in height, and is of brick and steel fireproof construction, the brick being steel-gray in color with trimmings of Indiana limestone. Foundations are of block granite, laid in hydraulic cement. The first floor contains the business and executive offices of the institution, a music store, various class rooms, two auditoriums and a private branch telephone exchange and information bureau. Below the street level is a basement containing the boiler and engine rooms of a 300-h.p. power plant, a printing department, elevator machine room, fan room and tuning apartments. On the second floor are a musical library, galleries and miscellaneous instruction rooms, while the third floor is also devoted mainly to teaching purposes.

The building is entirely illuminated by incandescent lamps, Holophane globes being attached to all one-light ceiling fixtures in corridors, while one-light fixtures in offices turn downward at an angle of 45 deg., and have porcelain dome-shaped scalloped shades. All ceiling fixtures in offices for more than one light are simple clusters with porcelain shades. The auditorium lights are especially effective. In the larger auditorium 200 lamps of 16 c.p. are installed above a skylight, which give, with the help of a row of border lights, a result approaching sunlight illumination.

The larger auditorium constitutes one of the most interesting features of the building. It seats over 1,000 persons, and its equipment includes a large electro-pneumatic pipe organ built by the Hutchings-Votey Co., of Boston, and a large stage for operatic work. The key desk of the organ is connected with the instrument by cable, and is placed in front of the stage, 50 ft. from the organ itself. The acoustics of the auditorium have been highly praised and are described in an article of unusual interest by Mr. Frank Waldo in the New England Conservatory Magazine of January, 1904. The smaller auditorium seats about 400 people. The total number of lights in the large auditorium is 899. The entire building is equipped with over 3,000 incandescents.

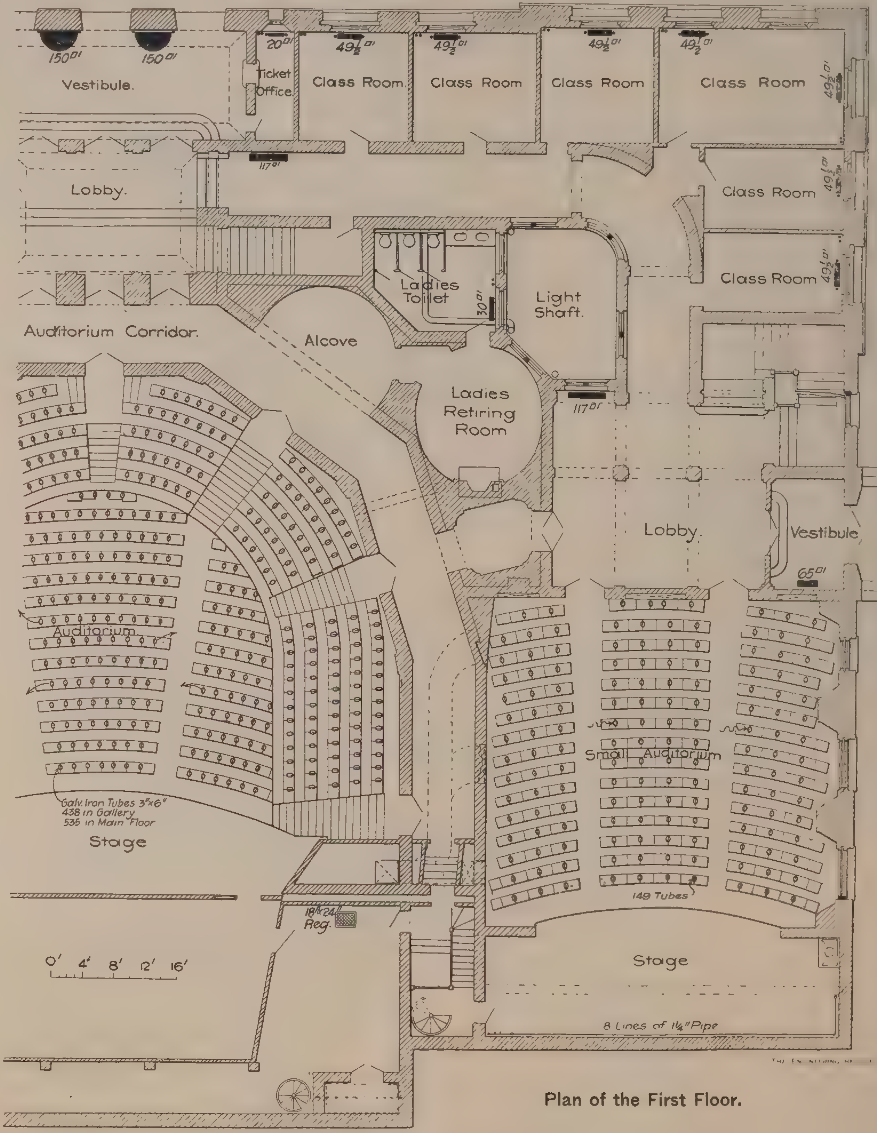
The power plant is located in the basement on the Huntington Ave. side of the building. Beneath the sidewalk is a coal bin with a capacity of about 100 tons of soft coal. The boiler room is exceptionally well lighted and ventilated. It contains in steam generating equipment two Cahall sectional horizontal water-tube boilers, rated at 150 h.p. each. There are 3,000 sq. ft. of heating and 70 sq. ft. of grate surface. The heating surface of each boiler consists of one steam and water drum 36 in. in diameter and 20 ft. 2 in. long, and eight sections of tubes, each set consisting of nine tubes 4 in. in diameter and 18 ft. long.

The steam-delivery outlet is 5 in. in diameter with an 11-in. flange. A full set of Foster shaking grates and bearers is provided. The smoke flue is made on an angle-iron frame and is stayed to maintain its shape. It is painted inside and out with black asphaltum. The damper is controlled by a Locke automatic damper regulator. The flue is covered with 1 in. of asbestos air-cell block strongly wired and 1 in. of asbestos plaster. City water is used in the boilers, and in cold weather this is used over and over in part as drip returns from the heating system, which is equipped with the Paul system of vacuum circulation. The water for the boilers is passed through a 300-h.p. National feed-water heater.

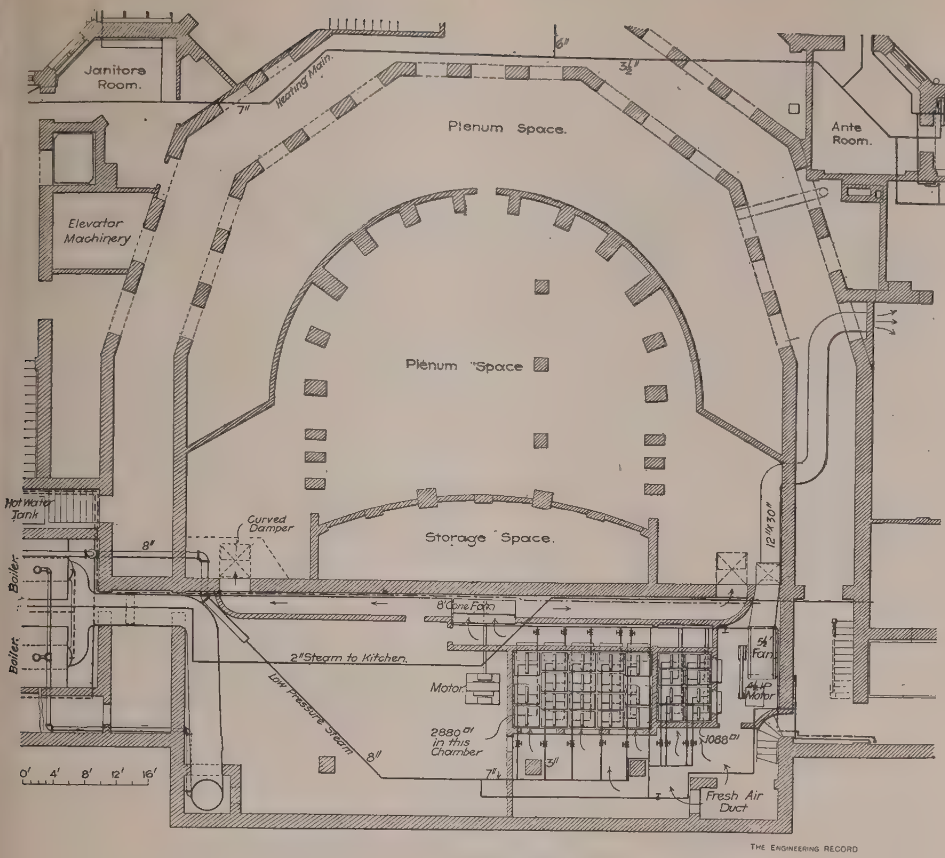
Coal is weighed in the boiler room by a 1,000 lb. Fairbanks wheelbarrow scale, without wheels, but fitted with an incline for convenience in handling the loads of fuel. To facilitate inspection and repairs the boiler room and other portions of the plant are equipped with iron ladders. The hot-water tank is made of wrought iron, and is 36 in. in diameter by 8 ft. long, the plates being ¼ in. thick with one dished and one cast-iron head. The feed pump was built by the Knowles Steam Pump Works and is of the duplex brass-fitted outside-packed plunger type. Its cylinders are 6x4x6 in.

Adjoining the boiler room is the engine-room, containing at present two generating units. Each unit consists of two 50-kw. Crocker-Wheeler generators direct-connected to a 16x14-in. horizontal single-cylinder non-condensing Ames engine making 275 r.p.m. One dynamo is placed on each side of the engine. At 100 lb. steam pressure and 5 lb. back pressure the engines develop 150 b.h.p., or sufficient power to operate the dynamos at full load 20 hr. per day, without undue heating or strain, and with a steam consumption of not over 31 lb. dry steam per indicated horse power per hour, and 28.5 lb. with no back pressure. The governor regulates the speed of the engine within one per cent. from no load to full load, and the momentary speed variation (in 3 seconds) does not exceed 2 per cent. when full load is thrown suddenly on or off. The governor is designed to operate correctly within very close limits between the steam pressures of 80 and 120 lb.

The engine shafts are of hammered steel, coupled in three pieces for each engine. All the bearings are fitted with removable cylindrical shells lined with babbitt, and underneath the boxes are oil rings and cups, with a large reservoir for oil supply. Each engine has two flywheels, one for governing and the other for additional balancing, cast in two pieces, bolted and pinned together. The main bearings are supported by the frame, and the sub-bases are extended in both directions to receive the dynamos and outboard bearings. The valves have ground seats and are driven by an eccentric controlling admission and exhaust. Arrangements are provided for varying the cut-off as desired.



Plan of the First Floor.



Plan of the Basement.

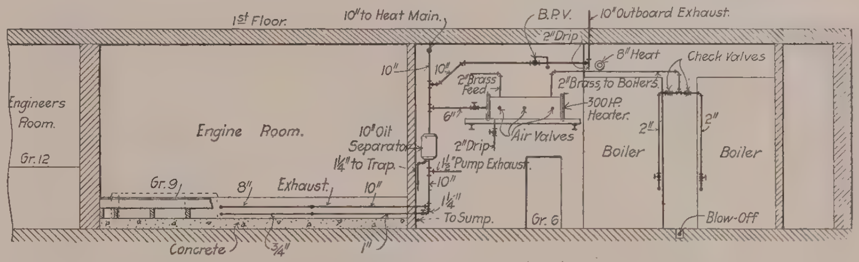
The pistons have ring packing, held in place by steam pressure, and by springs when not acted upon by steam, while the stuffing box packing is metallic. The crank and cross-head pin boxes are provided with take-ups for compensating for wear. All the engine valves are of the Chapman gate type with bronze seats.

Each of the two dynamos direct-connected to each of the two engines is compound wound for a constant potential of 125 volts. The ordinary operating potential is 115 volts. The distribution circuits are laid out on the three-wire system, each pair of dynamos being connected in series for 230 volts on the outer leads with a tap in the middle for 115 volts.

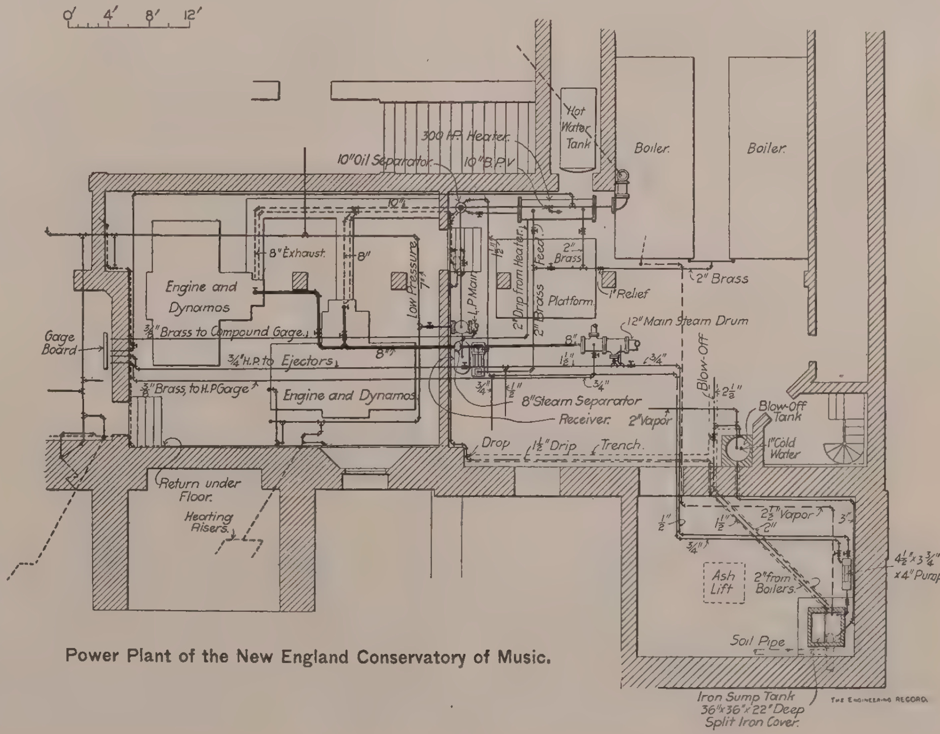
The piping, heating and ventilating system was installed by Messrs. Lynch & Woodward, of Boston, and the ventilating fans were supplied by the B. F. Sturtevant Co., of the same city. The auditoriums and tuning rooms, with some offices, are ventilated by air supplied through special fans. The rest of the building is heated by direct radiation, with the exception of the library, which is warmed by the gravity indirect system. Air for the main auditorium is supplied by an 8-ft. cone fan located in the basement. It has a maximum speed of 163 r.p.m., and is direct-connected to a Sturtevant motor. This motor is provided with a Cutler-Hammer rheostat that enables its speed to be cut down to 60 r.p.m. The air which the fan forces into the auditorium first passes through a heating chamber in the basement that contains steam coils. It then goes to the auditorium by a galvanized-iron duct, and is led into the hall through ducts in the legs of the seats. The foul air is exhausted from the hall by means of a 9-ft. full housing up-discharge fan located on the roof, with a special outlet, 6x4x½ ft. in dimensions. The fan has a maximum speed of 112 r.p.m., a double inlet, and rests on a 3-in. hard pine plank bedded in concrete on the roof. It is driven by a 10-h.p. motor running at 650 r.p.m. and mounted on a 6-in. Portland cement base. The small auditorium is supplied with air by a 110-in. plate fan with a maximum speed of 150 r.p.m., belted to a 4½-h.p. Sturtevant motor. It is vented by a 66-in. vertical-shaft propeller fan set on the roof.

Toilet rooms are vented by a 36-in. direct-connected vertical-shaft propeller fan. The tuning and class rooms are supplied with air by a 55-in. full-housing down-discharge fan having a maximum speed of 250 r.p.m. The executive offices are supplied with air by a 36-in. motor-driven propeller fan set on a steel framework in the basement. There are 4,720 sq. ft. of indirect and 6,331 sq. ft. of direct radiator surface in the building. Direct radiators are of the H. B. Smith Co.'s Princess and Diadem styles. The main heating chambers are supported on 4-in. I-beams, and radiators are supported on T-irons with two 4-in. channel irons next to the building column. Indirect stacks of 6-in. pin radiators are supported by ⅝-in. and 4-in. by ½-in. bars. Air pipes of the Paul system were tested tight under 20 lb. water pressure on the third floor, and were guaranteed to hold that pressure on the system for 2 hr. without dropping it. Registers were made by Messrs. Tuttle & Bailey, and are of the plain latticed pattern. The Powers automatic system of temperature control is installed throughout the building. The ceiling under the stage, the spaces above heating chambers, the ducts and cold-air room are all lined with No. 24 galvanized iron.

The piping of the plant is suspended on adjustable expansion hangers, the pipe rings being of wrought iron. All pipes passing through partitions have heavy collars of galvanized iron with wired edges. These collars extend ¼ in. beyond the face of the wall on either side. Pipes which pass through brick walls have iron collars, and those which pass through floors are fitted with heavy galvanized-iron tubes with wired edges at the lower end. Floor plates are all of cast



Section through Boiler and Engine Rooms



Power Plant of the New England Conservatory of Music.

metal, nickel plated, and only wrought-iron pipe was used. Piping subjected to boiler pressure is extra heavy, and flanges down to 3 in. have their faces turned off to leave a bearing of 1 in. inside the bolts. Extra long turn ells are of the Walworth Mfg. Co.'s pattern. The piping on the boiler fronts is of polished brass.

The engine exhaust is carried away by a 10-in. pipe leading to a Common-Sense exhaust head located above the roof. An 8-in. steam main leads from the boiler to the engine room, and a pipe of the same size runs to the hot-air chambers from the boiler room. A Cochrane oil separator is installed in the exhaust system.

The blow-off tank of the boiler room is set on brick foundations about 3 ft. above the boiler-room floor. Its 3-in. overflow pipe discharges into a sump pit 4 ft. square and 2 ft. deep, fitted with a wrought-iron sump pan 3 ft. square, made of ¼-in. boiler iron, bedded in concrete. The sump pump is a 4½x3¾x4-in. Knowles duplex pump, controlled by a 2½-in. Waters governor valve operated by a float in the sump. All gate valves are of Chapman make, radiator valves are of Jenkins Bros.' make, while reducing and relief valves are of the Kieley make. Except in the boiler room the low-pressure piping is covered with wool felt sectional covering ¾ in. thick, wrapped in 8-oz. duck canvas.

The switchboard is composed of five blue Vermont marble panels. Four are generator panels, one for each machine, and the fifth is for the feeders. The generator panels each carry a triple-pole double-throw lever switch, one double-pole Cutter circuit breaker, a volt-meter switch and plug, field rheostat, and one 750-ampere Weston ammeter. Between the panels of the two generating units are mounted two General Electric automatic voltage regulators, one to each pair of panels. The totalizing panel includes three Thomson recording wattmeters built for 220 volts.

The passenger elevator service is cared for by a drum type elevator operated by a 25-h.p. 220-volt Crocker-Wheeler motor. It was built by the Marine Engine & Machine Co., of New York. There are also two hydraulic lifts, supplied by the Whittier Machine Co., of Boston, and operated by city water at a pressure of 55 lb. per square inch. One of these is a piano lift, with a platform 7x10 ft. and a capacity of 1 ton. It has a rise of 7½ ft., and a speed of 25 ft. per minute. The plunger is of steel tubing 10½ in. in diameter. The other lift is an ash hoist, with a platform 4 ft. square, a 7½ in. steel plunger, rise of 13 ft., capacity of 800 lb. and speed of 25 ft. per minute. A water meter is attached to each elevator and the pits are finished in concrete. The plumbing throughout the building was installed by Messrs. Pierce & Cox, of Boston.

The architects of the building were Messrs. Wheelwright & Haven, of Boston, and the general contractors were the Thompson-Starrett Co. The engineers of the plant were Messrs. Hollis French & Allen Hubbard, of Boston, and to their painstaking designs is largely due the operating success of the establishment. The engineer in charge of the plant is Mr. Charles Jordan, and the manager of the Conservatory, who has the general oversight of the entire building and executive affairs of the institution, is Mr. Ralph L. Flanders.

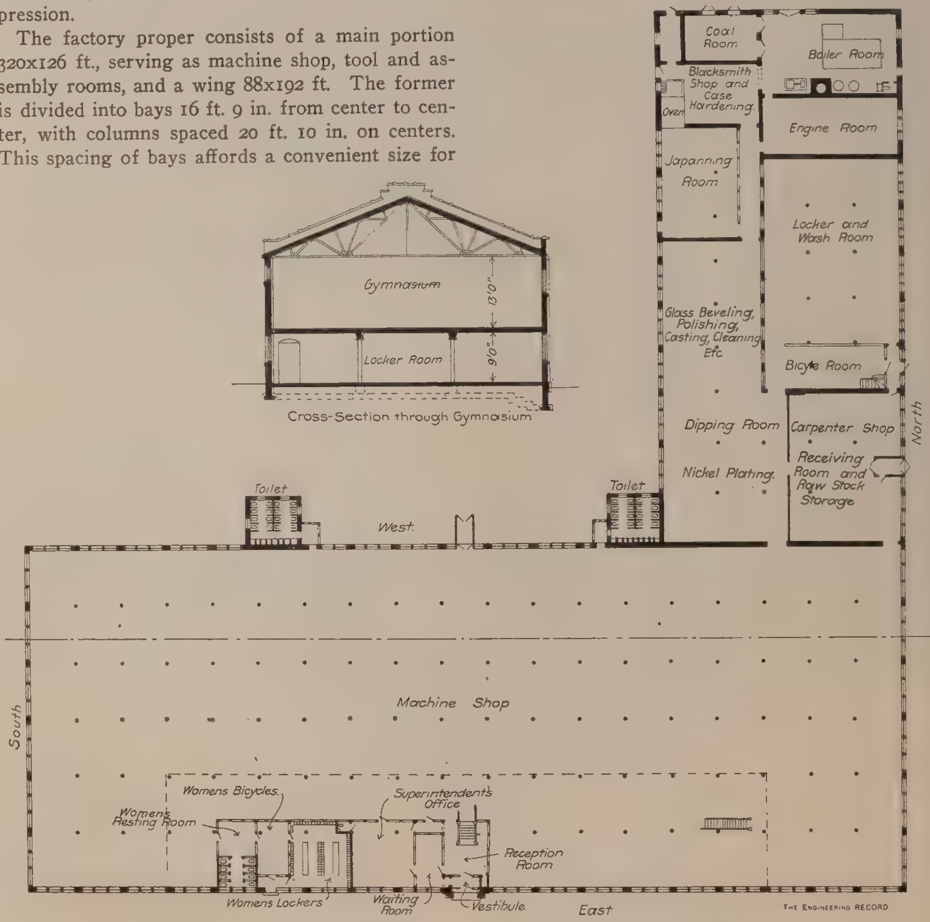
The Increase of Volume of Molten Cast Iron saturated with carbon in the electric furnace at the moment of solidification was recently discussed by M. Henri Moissan in a communication read before the Paris Academy of Sciences. Iron which is free, or nearly free, from carbon increases in density in passing from the liquid to the solid state, but on the contrary, when saturated with carbon at the temperature of the electric furnace, it is said to increase in volume when solidifying.

The Factory of the American Arithmometer Co.

The accompanying illustrations show a factory recently completed at Detroit for the American Arithmometer Co., manufacturers of the Burroughs adding machine, who until October, 1904, were located at St. Louis, Mo. The factory site is 320 ft. square, in a beautiful part of the city. The factory portion is one story in height, the two-story parts of the building being the offices and gymnasium.

The office part extends along Second Ave., occupying a frontage of 230 ft. and is 42 ft. deep. The main entrance admits to a reception room in the center of the building on the ground floor. From it a marble staircase leads to the general and private offices above. The superintendent's office opens at one side of a reception or entrance hall. The partitions around this latter are filled with clear plate glass, thus affording a general view of the factory, at once giving an excellent first impression.

The factory proper consists of a main portion 320x126 ft., serving as machine shop, tool and assembly rooms, and a wing 88x192 ft. The former is divided into bays 16 ft. 9 in. from center to center, with columns spaced 20 ft. 10 in. on centers. This spacing of bays affords a convenient size for lengths of shafting, all of which is arranged to be interchangeable. All parts of the shop are flooded with light, saw-tooth roofs making this possible. The general construction and sizes of these saw teeth have proved very satisfactory. The gutters between are of ample size; the window sills are 16 in. above the highest point of the gutter to allow for heavy falls of snow, and the sash are 7 ft. high. The gutters empty into copper sumps, and are connected to the interior cast iron columns. These latter are coated on the inside with asphaltum, and serve as conductors. Below the sash of the saw-tooth roofs are provided small condensation gutters of copper, which connect into every column. Every other sash in the saw teeth is arranged to swing on center pivots. These are operated by geared ventilating apparatus.



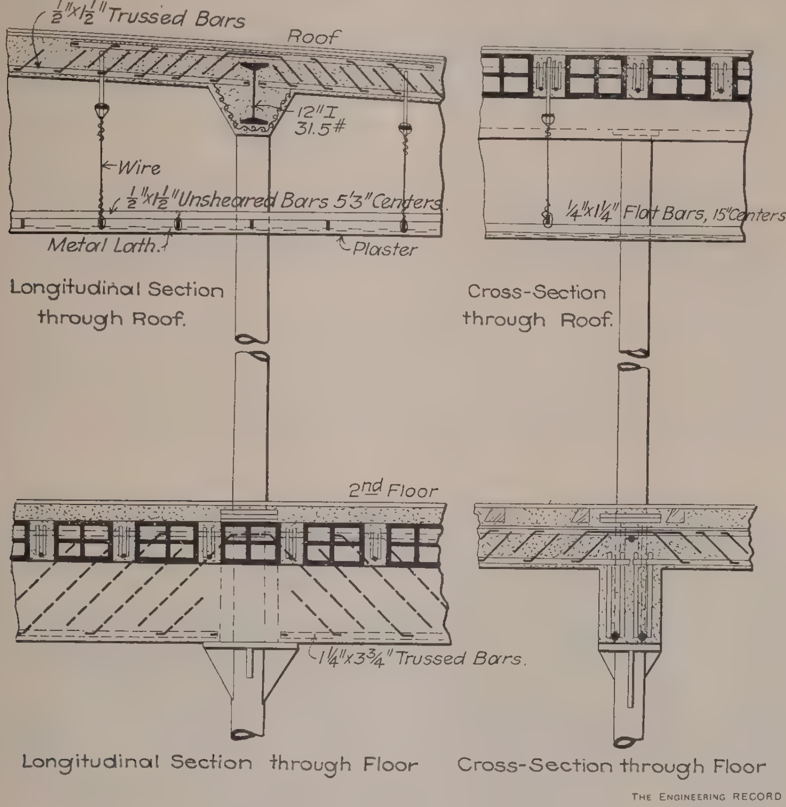
Block Plan of New Detroit Works of American Arithmometer Co.

The wing contains shipping, stock receiving, nickel plating, glass beveling and japanning rooms, blacksmith shop, engine and boiler rooms, and the employees' entrance, locker and washrooms, and bicycle room. A stair leads from the employees' entrance to the gymnasium on the second floor, 50x85 ft. in size, and 14 ft. high to the lower member of trusses. A dressing room, shower and toilet are provided for the gymnasium, which latter is used by employees for meetings, balls, conventions, games, etc.

The locker room contains 340 expanded metal lockers in double rows. The lockers are 12 in. by 12 in. by 5 ft., and the double rows are spaced about 10 ft. from center to center. Double enameled iron wash troughs, supplied with hot and cold water, are placed between the lines of lockers. Two toilet rooms for men open off the machine shop, one at each end. For the women employed, a locker and wash room, bicycle room, toilet room and a resting room are provided in the front of the building and adjoining their department.

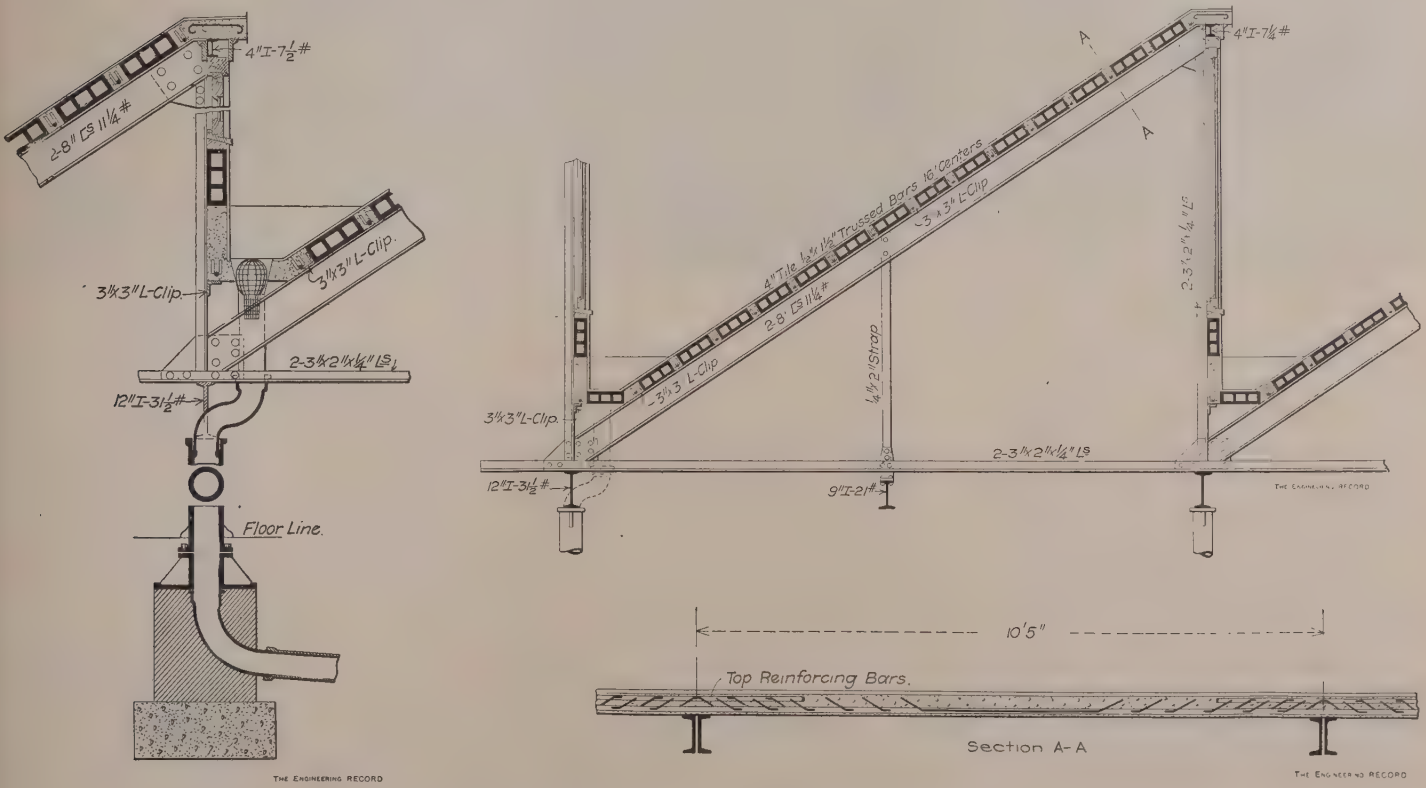
The second floor office portion provides for the general offices of the company, the various officers, manager and assistant manager, stenographers, draughting rooms, private experimental rooms, locker and toilet rooms for office men and women, as well as toilet for the officers, also a two-story vault for the storage of books, etc.

The building is constructed of non-combustible material throughout, with brick walls, faced on the outside with a standard size paving brick, and on inside in the factory portions with sand and lime bricks, enameled five coats, and presenting the appearance of enameled bricks. The floor and roof construction throughout is of the Kahn system of hollow tile and reinforced concrete. The spans vary from 16 to 20 ft. In this construction hollow tiles are laid end to end on wood forms in straight rows, the rows of the tile being about 4 in. apart. In these 4-in. spaces are dropped first 1 in. of cement concrete for fireproofing, then the Kahn trussed bar with its rigidly attached prongs pointing diagonally upwards, and then the spaces are filled with a wet mixture of cement concrete, thus forming a series of reinforced concrete beams approximately 16 in. center to center. The floor tile and beams average 10 in. in depth, and are calculated to carry 100 lb. live load, with a factor of safety of four. Tests of four times the live load produced only slight deflections.


½"x1½" Trussed Bars
Roof
12" I 31.5#
Wire
½"x1½" Unsheared Bars 5'3" Centers
Metal Lath.
Plaster
Longitudinal Section through Roof.
¼"x1¼" Flat Bars, 15" Centers
Cross-Section through Roof.
2nd Floor
1¼"x3¾" Trussed Bars.
Longitudinal Section through Floor
Cross-Section through Floor

The Engineering Record

Sections Taken in Office Building.



The Engineering Record

Details of Saw-Tooth Factory Roof and Its Drainage into Columns.

The roofs are similarly constructed with 4-in. hollow tile and concrete beams, the inside being plastered a heavy coat of cement mortar, the outside covered with Carey's standard magnesia roof covering, with which also the gutters are lined. The roof spans are 10 ft. from truss to truss. This form of hollow tile and cement construction has proved thoroughly satisfactory in every way, light in weight, easily and quickly installed, and comparatively inexpensive, costing in this case about 10 per cent. more than ordinary mill construction. Its sound-proof qualities as well have been put to the fullest test in the office building, and the results have proved successful.

Fireproof roof construction has always been somewhat of a problem; various forms were considered, among them solid concrete, hollow tile between steel purlins, ferro-inclave, etc. The form adopted proved not only less expensive but entirely free from all condensation, an objection so common in most concrete constructions. Details of the construction as designed by the Trussed Concrete Steel Co., the manufacturer of the trussed bar and contractor for the work in this building, are shown in the illustrations.

The building is heated with the Evans-Almiral Co.'s system of hot water heating. Power is for the present obtained from the Edison Company, though boiler capacity and engine room are provided for future installation of power plant. The factory portions are heated by pipe coils suspended from the walls below the windows, and from the base of the saw-tooth roofs directly under the sash. The latter arrangement materially assists in keeping the gutters between the roofs free from ice and snow. The office portions are heated with direct cast iron radiation. The mains supplying the coils in the machine shop are run just above and supported on the I-beam grillage which supports the shafting and the roof construction. No pitch of pipes is necessary in the adopted form of heating. This permits of a very neat arrangement of piping.

The piping generally is painted in aluminum bronze. The entire interior of factory is painted white, and the cleanly appearance excites not only the general admiration of visitors, but proves inviting to the employees. The attention paid to the details for the latter's comfort and health has in this case proved of direct benefit to its owners, as it has in most similar cases. Good workmen from many other plants are seeking employment here.

The building is lighted by electricity. All wiring is run in pipe and tile conduits. The machine shop is in general lighted by large arc lamps suspended overhead, but each machine has an individual incandescent light supported on a ½-in. pipe standard, which is a continuation of the conduit system, being brought up through the concrete floor, and contains the wires.

The architect for the building was Mr. Albert Kahn, Union Trust Building, Detroit.

Difficulties With a Pump Well.

During the past year a pump well has been constructed at the Absecon pumping station of the Atlantic City, N. J., water-works, which offered some troublesome obstacles to the steady prosecution of the work. The well was designed as a reinforced concrete basin 25 ft. in diameter and 26 ft. deep. It was first undertaken early in June by a contractor for the sum of $4,475.

When at a depth of about 15 ft., the wooden curbing which was being sunk outside the proposed concrete wall showed signs of failure. The contractor strengthened the curbing, but not sufficiently, as it began to fail again when about 24 ft. in depth, July 19. About 4.30 P. M. July 20 the flow of water up through the clay bottom from a 4½-in. test boring made the previous year increased to such an extent that a 6-in. and a 2½-in. pulsometer could hardly handle it. An attempt was made to confine the flow by inserting a 6-in. and later an 8-in. pipe; but on account of a brace located above the hole the pipes were not plumb and matters were made worse. About 50 bags of sand were placed about the hole without stopping the flow and then small bags of hair, oakum and sand were rammed through the 8-in. pipe to the cavity below with a length of 4-in. pipe. These were ejected in a bunch. Finally, July 23, the flow was partially stopped by ramming in manure. In the meantime the curbing continued to fail near the bottom, and the material outside of it to settle.

Superstructure Ready for Slate Roof.

Condition of Work When Undertaken by Department.

The work being entirely beyond the control of the contractor, no further work on it was done by him. The Water Department, of which Mr. Kenneth Allen is engineer and superintendent, then assumed charge of the work, and after considering different plans decided, first, to attempt to control the flow of water by sinking a 10-in. tubular well through the clay, to be permanently operated in conjunction with the artesian wells; and, secondly, to encase the entire work with an octagon of 6-in. tongued and grooved sheet piling driven into the clay. Mr. Thomas B. Harper was immediately engaged to sink the well, the Pneumatic Engineering Co. to connect it with the air lift plant, and lumber was procured. By Aug. 2 the well boring outfit and sufficient lumber to make a start with were on the ground, by Aug. 20 the well was completed, and by Sept, 1 the sheet piling was finished.

On Sept. 20 the work by the Water Department on the pump well was resumed. The old casing was in such condition that it was useless to attempt to utilize it in completing the work. The 6-in. sheet piling surrounding it, which was in lengths of 24 and 26 ft., was believed to be driven sufficiently into a clay stratum lying about 20 ft. below the surface and, according to the log of the artesian well drilling, some 20 ft. in thickness. It was thought that if the clay were excavated to the neat outer diameter of the concrete curbing to the bottom of the foundations, the bench of clay remaining would prevent lateral displacement at the bottom, while the top could be braced as required.

The old curbing was, therefore, removed and excavation carried out to the sheet piling. As the work was carried down the volume of water increased, but was handled by 6-in. and 2-in. pulsometers without difficulty. The artesian well, although delivering by means of compressed air a volume roughly estimated at a million gallons per day, drew the natural level down but about 4 ft. in the pump well.

Owing to the sloughing in of material and the work required in bracing the piling and caulking leaks with oakum, it was Oct. 4 before the depth reached by the contractor in July was regained. By Oct. 7 a system of bracing of round timbers cut in the vicinity was completed, and on Oct. 8 a depth of 28.9 ft. below the surface was reached, which was the required depth of the foundation in the center.

It may be said here that the old pump well, through which the entire supply passes, and which was similar in size, but without a concrete bottom and with the walls laid dry, was located but about 18 ft. from one side of the octagon of sheet piling, and any failure of this by scour of the earth separating the two would have been disastrous, cutting off the water supply of the city for an indefinite period. On Oct. 10 about 5 p. m., just before leaving the work, Mr. Allen noticed a decided increase in the scour on this side and, as there were signs of displacement in the sheet piling in several places, he had short lengths of 2-in. plank driven close to the sheet piling with mauls and the leaks reduced by nailing on battens or by caulking. But by the next day the surface had caved in to within 5 ft. of the old well. A line of 2-in. plank was accordingly driven by hand between the two wells and braced against the sheet piling, while the cavity was filled with alternate layers of hay and clay. No further settlement occurred at this place.

On Oct. 14 an attempt was made to control the flow up through the test well boring by enclosing the 8-in. pipe with a 20-in. cast-iron pipe sunk 3 ft. in the clay bottom. This was entirely effective at first, but later the water forced itself up around the outside, and a section of 42-in. wood stave pipe about 16 ft. long was then driven around the 20-in. pipe. This was sufficiently effective to allow the work to be continued.

By this time the bench of clay was so far washed away that the sheet piling was being undermined in several places, and it was urgent that no time should be lost in getting in the concrete.

The water came in from all directions so freely that it was not deemed advisable to lay the concrete without protection, so this was placed in bags and these laid in a footing course 4 ft. wide and 2 or 3 ft. thick around the circumference of the well; and as it was feared that a considerable cavity might exist in the clay, permitting failure of the upper crust by the hydrostatic pressure, the interior was loaded by covering it with bags of sand. When ready for the concrete bottom these bags were removed, and by Oct. 27 the concrete bottom was completed, reinforced with old iron rails, with top to grade, but some 8 in. thicker than originally planned, except at the test hole and the pump sump, between which a box drain had been laid below the foundation.

By Nov. 4 the walls were practically completed to the top. To prevent percolation through the footing of concrete in bags, the well was pumped out, and a ring of concrete 12 in. thick and about 2 ft. 6 in. high was built up from the floor against the sides. On Nov. 9 the three pipes were removed from the test hole, the flow from which had greatly diminished, and a few days later this and the sump were plugged by lowering concrete in bags and dumping under water. This work was successfully done. A contract was let for building a brick superstructure, the roof of which, owing to the weather, has not yet been slated.

The work, which was done under the direct supervision of Mr. Chester J. Myers, assistant engineer, was one of some difficulty and caused not a little anxiety for some weeks. Fortunately, no serious accident occurred. One man fell 15 or 20 ft. from a plank, but fortunately landed in a bed of soft mud and so escaped injury.

It should be said that, while the method of doing the work was intentionally left to the contractor, he was advised in the beginning to lower his concrete casing on a shoe and that the casing and bracing of wood actually employed was, as shown by actual tests of the material, not sufficiently strong to withstand the hydrostatic pressures to be encountered alone.

The Reinforced Concrete Bridge at Kankakee.

A paper read before the Illinois Society of Civil Engineers and Surveyors, by R. D. Gregg, City Engineer, Kankakee.

The concrete-steel bridge over the Kankakee River at Washington Ave., Kankakee, Ill., is 593 ft. long and 46 ft. wide, consisting of seven three-center spans, each 73 ft. in clear length, a 5⅓-ft. walk on each side, a 34-ft. driveway with a street-car track in the center. The rise at the center of each span is 8 ft. 5 in. The bridge was designed by the Concrete Steel Engineering Co., of New York, and built by the Marsh Bridge Co., of Des Moines, Iowa.

The old iron bridge at this place was a bow-string girder, with four spans, of 125 ft. each, and two spans of 50 ft. each, with an 18-ft. driveway, and a substructure of stone masonry resting on a rock foundation. The bridge having been condemned and the city not being in a position to build at once, the writer prepared plans for two frame bents under each long span and one under each short span. The bents were heavy sway-braced on which rested two 24-ft. corbels with heavy braces bolted to the vertical posts of the bents. The sills were fastened at each end to the rock with 1¾-in. lewis bolts. Between the corbels and floorbeams heavy double wedges were placed and adjusted to carry about half of the weight of the floor system. This manner of bracing was also intended to save the bridge from injury in case of an ice gorge. The bents withstood the ice for three years, and last spring an ice gorge carried away a section of the Kankakee dam and two frame bents without damage to the bridge.

Atlantic City Pump Well: Old Wood Curb Surrounded by 6-in. Sheeting; Excavating Between Old Curb and 6-in. Sheeting, Sept. 24.

The depth of the river at the bridge site during low water is from 3½ to 4 ft., and its velocity about 4½ miles per hour. High water is 13 ft.

In laying out the new bridge two sets of reference points were used, from which a center line at the downstream side of the bridge was established. Two bench marks of different elevations were used, all of which served as checks.

The abutments are rubble concrete resting on a rock foundation; the rubble stones were separated by at least 4 in. of concrete and were not nearer than 10 in. to the surface. Skewback seats were formed by carrying the abutments up within 2 ft. of and a distance of 5 ft. horizontally back from the spring line and then sloping them up to the top of the abutments, radially with the arch ring.

All concrete piers were built up within 2 ft. of the spring line and depressions of about 5x18 in. made on top at the center and nearly the whole length of the piers. The work was stopped 2 ft. below the spring lines in order to provide for the anchorage of the arched ribs. Forms for the abutments and piers were made of ¾-in. white pine fence flooring, 2x8-in. studding and 4x6-in. waling strips, and were held in position by ⅝-in. rods passing through the piers and through gas pipes, which extended to within 2 in. of the surface of the piers; by this means the forms were firmly held in position and the rods very easily removed. For the abutments the forms were braced in the usual manner. Test holes were drilled into each pier and abutment foundation.

A temporary foot-bridge was erected on the upstream side of the bridge site, and the frame bents were made wide enough to carry a car track of standard gauge for the hauling of materials.

A Smith concrete mixer was placed on a platform about 10 ft. above the street at the north end of the bridge, from which an inclined car track extended to the street level and into the rock and sand piles; this track was provided with a spur track. The mixer was charge by two hopper-shaped cars, the bodies of which were made of boiler plate and provided with vertical slide doors attached to levers, for opening and closing. Each hopper was divided into two compartments by movable partitions, one for measuring sand and the other for crushed stone. The cars were attached to a cable which passed around a drum controlled by a friction clutch. The levers for controlling the mixer and hoisting apparatus were placed so that one man could operate both without changing his position. A second mixer was placed at the south end of the bridge a few feet above the street level and was charged by wheelbarrows.

All concrete for the bridge was mixed by batch mixers and turned from ten to fifteen times. Each batch contained one sack of cement, while the sand and crushed stone were varied according to the proportions required. Where wheelbarrows were used for charging the mixers, they were marked with upholstering tacks to gauge the proportions.

The street car track was left on the old bridge, over which was operated a railroad push car by means of a hoisting engine and cable. Under the mixer a platform was erected slightly above the top of the push car. Four two-wheel wheelbarrows, each sufficient to hold one batch of concrete, were used in connection with the car. A wheelbarrow track or platform was placed over each pier at about the spring line, where one wheelbarrow was placed under a vertical spout through which the concrete was dumped from a platform on a level with the push car, then the barrow of concrete was run to any point over the pier as required. The above means materially prevented the coarse concrete from separating from the fine.

After the abutments and piers were completed the street car track was moved to the temporary foot-bridge. The extreme height from the bed of the river to the street level is 23 ft. This and the narrowing of the waterway 40 ft. necessitated the use of a vertical curve for a grade line and raising of the spring lines in order to provide sufficient waterway. The center of the bridge is 2½ ft. higher than the ends.

The centers for each arch consisted of six framed bents, properly spaced, sway-braced and braced longitudinally. The joists were Oregon fir, cut out of 3x12-in. planks, and supported by double wedges, resting on the bent caps. The lagging was 2x8-in. hard pine, surfaced one side, and all depressions filled with potter's clay. The ends of the joists at the spring lines were supported by the studding of the pier and abutment forms. The centering was unyielding, and no difficulty was experienced in striking it. The crown of the centers was raised 1/800 of the span above the intended height of the finished arch to allow for settling when centers were struck. Four sets of centers were used, and appeared to be sufficient.

The steel reinforcement of the arch rings consisted of Thacher bars 1⅛ in. in diameter, in pairs one above the other, and extending well into the abutments and piers. These bars were connected with ½-in. round rods with a hook at each end, which were closed with a hammer during the erection of the metal work; they were placed at intervals of 4 ft. The main bars of each arched rib are coupled by four turnbuckles; the ends of the bars that extended into the abutments and piers are provided with nuts and cast washers 4 in. in diameter. The arched ribs are placed 17 in. from center to center, and the lower bars of the ribs 3 in. above the lagging. The adjustment of the ribs was easily made by the turnbuckles during the turning of the arch. The thickness of the arch rings at the crown is 16.1 in., and at the spring line 32.6 in. The radii of the intrados of the arch are 21.78 and 97.82 ft.; the radius of extrados is 107.7 ft. Six sets of ¾-in. transverse Thacher bars were placed in each arch and tied to the arch ribs with small wire. The ribs were kept at the proper distance from the lagging by the use of wedge-shaped blocks which were moved ahead as the turning of the arch progressed. Medium steel of an ultimate strength of 60,000 to 68,000 lb. per square inch was specified for the arched ribs, which had a sectional area equal to 1/150 part of the total sectional area of the arch ring at the crown.

In building the skewbacks the concrete was dumped on a platform and then shoveled into place; this enabled the workman to keep the concrete thoroughly mixed and proved to be the best manner in which to place it in the skewback among the rods.

In turning the arches a one-third longitudinal section of the arch ring was taken as one day's work. The placing of the concrete was started simultaneously at each skewback and carried forward uninterruptedly until the section was completed. Extraordinary care was taken in placing concrete under the arched ribs. Shovelfuls of fine concrete selected from the batches were dropped 3 or 4 ft., and in narrow strips without scattering, and the coarse stone pulled on top with a shovel, and then this operation continued sufficiently to keep ahead of the balance of the work. Blade tamping was done with the shovel under the ribs, and especially at the connecting rods; by this means dense concrete was made at a difficult and vital part of the arch ring. Anchor plates for the spandrel wall forms were set at intervals during the work on the arch. The top of the arch was floated with the back of a shovel blade. With a little extra care a workman can put on a very good finish. This finish was followed with a 1:1 coating of cement and fine sand slushed on and brushed in until a uniformly smooth surface was made. An extra heavy coating was put on the joints between the longitudinal sections of the arch rings.

Atlantic City Pump Well: Sheeting Reinforced with 2 In. Plank Driven into Clay; Interior Bracing of Forms; Concrete nearly Completed.

The expansion joints in the spandrel wall over the spring lines are hidden by the pilasters. The walls were built in alternate sections, and potter's clay was used at all expansion joints instead of paper. A 4x4-in. shoulder was placed in the edge of the coping for a seat for one edge of the sidewalk; this will obviate an objectionable appearance of the walk should the fill settle.

The railing was built of paneled slabs reinforced with steel bars. It became necessary to place the trolley poles in the curb line instead of in the railing on account of the discoloration of the bridge by rust, splitting of railing posts by vibration and obstructing the view from the sidewalk. Cast-iron sockets for the trolley poles extended from the skewbacks up to the bottom of the curb; they were set in concrete, and were made considerably larger than the poles for the purpose of plumbing them.

All completed work was sprinkled from two to four times per day for a period of two weeks.

The spandrel filling was composed of clay gravel and broken stone; instead of tamping the filling, it was flooded for two days with a 2½-in. hose attached to a city hydrant.

The inlets of the 4-in. drain pipes over the piers at the skewbacks were covered with coarse stone, then a layer of crushed stone, and a layer of gravel. Wire screens were not used. There was no seepage whatever through the arch rings during or after the flooding of the fill.

Chicago AA Portland cement was used throughout the entire work. A Fairbanks cement testing machine of 2,000 lb. capacity was employed. The fineness required was 75 per cent. through a 200-mesh sieve No. 45 wire Stubbs gauge. Briquettes made from the residue of cement retained on a 200-mesh sieve showed comparatively no strength after one day in a damp chamber and six days in water. Out of 4,000 barrels of cement standing the above test for fineness, there would be 1,000 barrels of residue, equal in value to 1,000 barrels of ordinary fine sand. This would seem to indicate the great importance of finely ground cement. Briquettes of one part cement and three parts stone screenings through a 20-mesh sieve and caught on a 30-mesh sieve greatly exceeded the requirements of the specifications, which were 170 lb. for seven days and 240 lb. for twenty-eight days.

Apparatus for the boiling test consisted of a 5-gal. pail with a cover and a wire basket suspended inside. Gas was used for boiling the water, and the temperature was very easily regulated. The pats were placed in cool water, which was brought to the boiling point in about one hour.

Stone screenings were exclusively used, and the stone dust was not sifted out. Briquettes of one part cement and three parts screenings through a 30-mesh sieve showed a strength of 370 to 400 lb. after one day in a damp chamber and twenty-seven days in water.

Grades of concrete used were as follows: For piers and abutments, 1 part Portland cement, 3½ parts stone screenings and 7 parts broken stone that will pass through a 3-in. ring, or crusher run stone ¼ to 3 in. For spandrel walls, 1 part Portland cement, 3 parts stone screenings and 6 parts broken stone that will pass through a 2-in. ring, or crusher run stone ¼ to 2 in. For arch rings, 1 part Portland cement, 2 parts stone screenings, and 4 parts broken stone that will pass through a 1½ ring, or crusher run stone ¼ to 1½ in. For the railing, 1 part Portland cement and 3 parts stone screenings.

Where stone screenings are used it is necessary to make the concrete quite wet and to thoroughly tamp it, in order to make the concrete dense.

Conduits for the telephone and electric light wires were placed under the sidewalks, and a gas main was placed under the walk.

The bridge was calculated to carry a live load of 125 lb. per square foot, and a concentrated load of 17-ton steam road roller with an 11-ft. wheel base.

The centers of two spans were struck 22 days after the arch rings were completed. The settlement at the crown of the arches varied from ⅝ to ⅞ in.

A 17-ton road roller was run over the bridge 46 days after the last arch ring was completed.

Work was commenced April 15 and the bridge was completed Oct. 15, 1904.

Indoor Humidity.

Indoor humidity has again been discussed by a member of the medical profession, who takes the stand also that the excessively dry air of houses during the heating season is injurious to the human organization, because the dry air in passing over the membranes of the respiratory passages and the skin calls for an enormous output of the fluid elements of these tissues. This physician, Dr. Henry Mitchell Smith, of Brooklyn, N. Y., holds that this leads to glandular overactivity, and its consequent evils, but he does not offer the specific proofs which, it has been asserted, are lacking to show that direct deleterious effects are thus produced. In his contribution, which was made to the Brooklyn Medical Society, he mentions, however, some tests he had conducted with a radiator having an experimental moistening apparatus attached, and he obtained results which concur with general beliefs as to the relation of the humidity and temperature.

He found that with a relative humidity never below 50 per cent. nor above 70 per cent., 70° Fahr. was uncomfortably hot, 68° was warm and 65° comfortable. It was determined by repeated experiments that a temperature of 65° to 68° and a relative humidity of 60 per cent. produced the most comfortable conditions, which were in marked contrast to a temperature of 72°, with a relative humidity of 30 per cent. The former felt warm and balmy, he said, and the latter, notwithstanding the higher temperature, chilly and dry, and apt to leave the impression of draftiness. He did not describe the moistening apparatus, but said that the mechanism was such that the control of the temperature and of the moisture were independent.

Municipal Sub-Surface Construction Maps.

By Hubert S. Wynkoop, Electrical Engineer, Bureau of Electricity and Gas, Brooklyn.

The continual tearing up of the roadways of our cities is usually regarded either as a necessary evil incident upon rapid municipal growth or as an evidence of official negligence leaning in the direction of favoritism toward public service corporations or contractors. Neither view seems to be entirely correct; for while, on the one hand, these excavations are an index of progress, on the other they may be unnecessarily large and frequent or of unconscionably long duration.

The cost of pipe galleries is prohibitive, save in the more congested portions of our largest cities, and their employment even under conditions financially favorable is of doubtful expediency in the minds of a considerable number of conservative and competent engineers.

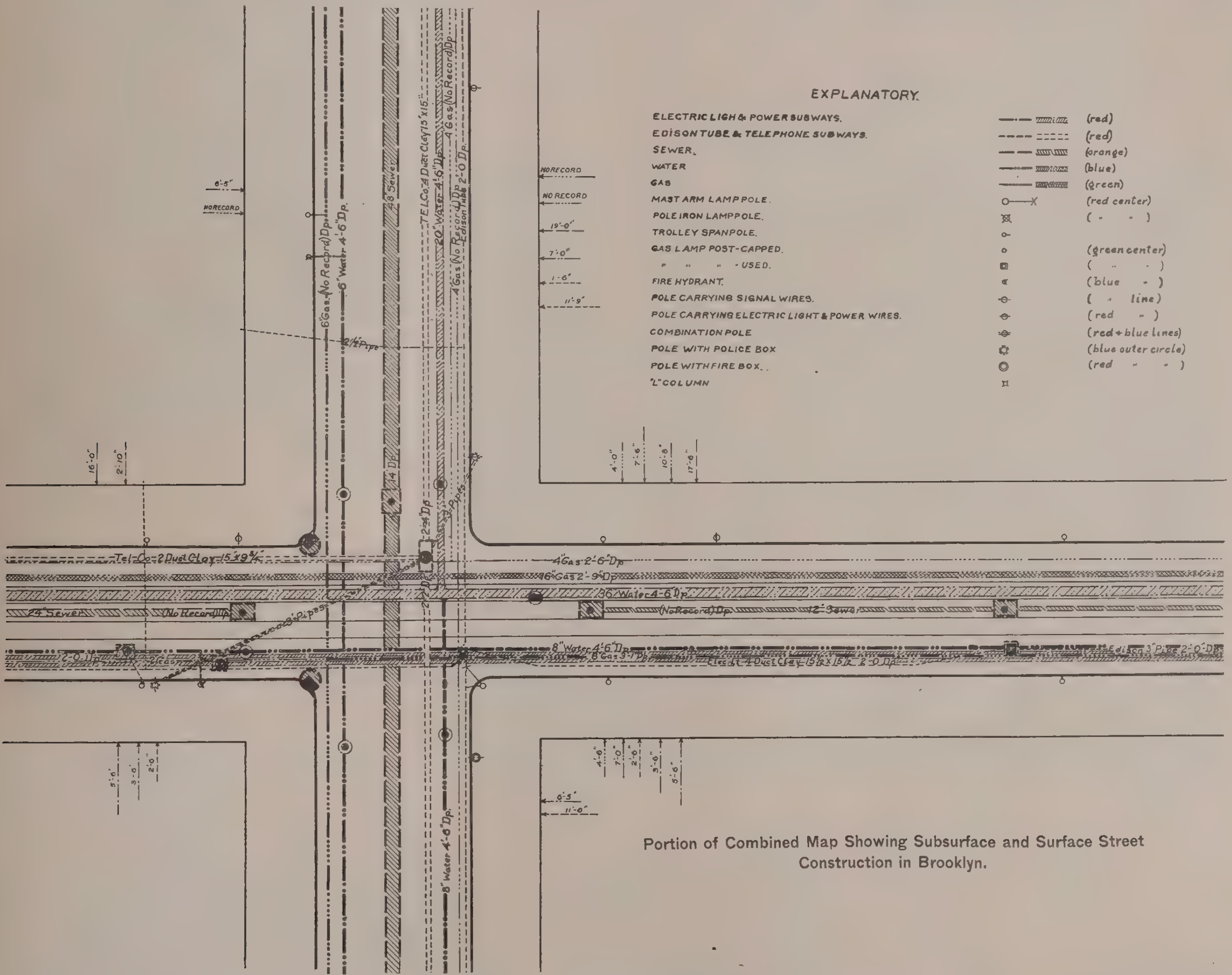
Water mains must be renewed and the system must be expanded in order to provide pressures sufficient to supply our skyscrapers and to minimize the fire risk. New sewers must be constructed to relieve flooded districts or to serve new territory. Old, rusty and clogged gas mains and services must be ripped out to give place to new and larger piping. Electrical subways must be laid down for the accommodation of conductors that may no longer hang in festoons from poles. Excavation for any of these purposes is in line with a healthy progress that makes for the public weal, and in so far as it is carried out promptly, it must be borne with. A city free from this condition is a city lying dormant. Unfortunately, the matter cannot be dismissed thus easily. A statement of the necessity is not an apology for the method.

Who has not seen excavation after excavation made, then enlarged, then filled in, then a new opening made beside the former one, then a barricade constructed and red lanterns brought forth, then utter cessation of work for many days? And who of us, inconvenienced by this situation, has not said things anent indifferent city officials and favored corporations? Now, criticize as we may, three facts cannot be ignored. First, the average city official is desirous of completing the sub-surface construction promptly because by so doing he may avoid criticism by both public and press. Second, the contractor wishes to get through quickly so that he may present his bill and go about other work. Third, the officers of the corporation want to see the hole filled and the repaving completed, for in each uncompleted job lie large possibilities of a damage suit. With all these interests working toward a common end it seems curious, at first blush, that the result is not more satisfactory. But a little investigation will uncover the explanation.

The investigation may perhaps take the shape of considering a sample case selected from the hundreds presented by any large city. Let us assume that a contract has been let for the laying of a large water main beside an existent main in a congested district. The water engineers have provided carefully detailed blue prints showing the size and location of the old main and the approximate location of the new main. They have provided for the connection of the new main with an old one on a cross street; and they have stipulated that only a small portion of the trench shall be open at any one time—in other words, pipe laying and back filling must proceed pari passu. In short, the contract is admirably drawn, the city, the public, the contractor and good engineering principles being given due consideration.

The contractor obtains a permit and, cutting out a section of pavement, begins to excavate. In a few minutes he unearths a gas main. He cuts out more pavement and drifts the hole toward the curb, only to stumble upon an electrical subway. Drifting still further, another gas main appears, and then a couple of lines of Edison tube. Conference with the water engineers results in a decision to shift one of the gas lines over a foot or so, and thus provide space for the new water main next to the electrical subway. The hole is filled in or barricaded, and a formal notice to shift its obstructing main is sent to the gas company.

The gas company—this is the ideal course—arranges with the contractor, after perhaps several days' delay, to shift its main as fast as the trench is opened; so work is resumed. Favorable progress is made until the pipe laying and the back filling have progressed nearly to the cross street carrying the old main with which connection is to be made. At this point it is discovered that a sewer branch leading from a catch basin lies directly in line with the end of the new main on the cross street. Either the branch sewer must be shifted or special pieces must be inserted in the new main to carry it past the sewer branch. What is to be done, and who is to pay for it? Up go the barricades, out come the red lanterns; and



Portion of Combined Map Showing Subsurface and Surface Street Construction in Brooklyn.

the work stops for several days while water engineers, sewer engineers, contractors' engineers and law engineers hold a conference as solemn as an autopsy.

Ultimately, by uncovering and regrading the water main just laid, and by shifting the sewer branch (which latter operation involves the running of a cross excavation from the center of the street to the catch basin on the corner) the contract is carried out, at what unnecessary waste of money and effort and time who can tell? And this useless expenditure might have been avoided if the contractor could have had access to a map showing in consolidated form all the information available as to sub-surface constructions.

I have known instances in which permits to dig test holes were taken out, merely because after consulting every conceivable source of information the contractor, an old hand at street excavating, was not reasonably sure that there was a clear course for the piping he wished to lay.

The city of Philadelphia some years ago awoke to an appreciation of the situation. The solution arrived at was prompt, efficient, profitable. Today a contractor desiring to open a Philadelphia roadway makes application for a permit, stating the character and extent of the proposed work and suggesting an approximate location. When the permit reaches him it is accompanied by a sketch drawn to scale and indicating the locations of existing constructions as well as the definite location assigned for the proposed work. The permit is accompanied by a bill for the information, usually charged for at from two to five cents a running foot. Cut-and-try methods of excavating are out of date in Philadelphia.

Municipal engineers, contractors and corporations with whom I have discussed this matter unite in endorsing the Philadelphia plan as an admirable one when viewed from any standpoint whatsoever. It gives information as to all subsurface constructions quickly and reliably; it enables the municipal engineers to conserve what little space remains beneath the roadways of congested districts; it saves the contractor much annoyance and expense; it insures the greatest possible dispatch in opening and closing the street pavement; and it not only pays for itself but returns a substantial surplus to the city treasury each year.

What Philadelphia has accomplished other cities may undertake, and the sooner the preparation of comprehensive sub-surface construction maps is begun the less laborious will be the ultimate labor attendant upon their completion. Let no town deem itself too small to undertake such a work. Who can predict what degree of future greatness lies in store for the little town? As to these maps, I advocate then, for cities, large beginnings; for towns and villages, small beginnings; but for each city, town or village at least a beginning, and now.

In connection with my own work I have begun the preparation of a set of sub-surface construction maps. The work is one of infinite labor, but is thoroughly justified by results. As the lines grew upon the paper the interest in the map increased, and our aims became more ambitious; so that the completed sheet contains an astonishing fund of information that it had not been intended originally to plot; for, in addition to constructions below the street surface, permanent street obstructions on or above the surface, such as car tracks, poles, lamp posts, hydrants and manhole covers, have been included, the whole forming what is, in my opinion, a complete highway map.

Consolidation on the map of information gleaned from various sources disclosed many a discrepancy; and herein lies an advantage of the consolidated map over a set of independent maps of water, sewer, gas and other systems. No matter how carefully the field work or the draughting may be done errors will creep in occasionally and methods of checking may sometimes fail. The consolidated map offers more chances for checking than do the individual maps, and is therefore more desirable.

Fewer errors occur in interpreting a given situation when all constructions appear in related position on one sheet, and one does not have to consult several drawings placed side by side and to make mental transfers of one map to another.

Instead of discrepancies we sometimes discovered links that were missing. These seldom occurred in connection with the most modern systems such as the electric, field notes of which have been kept methodically from the start; but with water, sewer and gas systems we were balked in some cases owing to the absence of records. In such a case recourse was had to the memory of the oldest employee; and failing in this we must take to actual prospecting with pick, shovel and tape line at the first opportunity. Is it any wonder that street excavating as usually practised is largely a matter of cut-and-try, when we, who know from long experience just where to search, are often unable to obtain from the records the desired information?

The accompanying cut illustrates part of one of our completed maps. It is impracticable, unfortunately, to reproduce the coloring which is a very important feature, as it renders surprisingly easy the task of tracing the course of any pipe as it threads in and out among its neighbors.

The color scheme is as follows: Curb lines, house lines, tracks and all surface or super-surface constructions are in black; all sub-surface constructions are in colors, as indicated by the parenthetical notes attached to the key on the cut. Sidewalks are washed in with pale yellow. Practically all lines are solid, the color affording sufficient distinction.

The scale is 20 ft. to the inch. Dimensions and depths are charged directly upon the constructions; but distances from curb are indicated by appropriately colored and numbered offsets placed back of the house line. Linen-backed drawing paper, 19 by 27 in., is employed.

The map is an interesting study, as much for the records that are missing as on account of the positive information furnished. How far from the curb and how deep is a certain gas main? Into which sewers do the various catch basins drain? How far below the street surface does the sewer lie? In many cases these and other questions can be answered only through the aid of pick and shovel, tape and sounding rod. There are no records.

Effect of Freezing on Mortar.

The results obtained in a series of experiments to determine the effect of freezing on the tensile strength of neat cement and cement mortar are given in the accompanying table. The tests were made on briquettes of German Portland cement, of which 0.2 per cent. remained on a No. 50 sieve, 2.4 per cent. on a No. 74 and 3.1 per cent. on a No. 100. The sand employed for the mortar briquettes was largely of very fine grain so that only the portion which passed a No. 30 and remained on a No. 50 sieve was used. In mixing the neat cement, 20 per cent. of water was used, while in making the mortar 1 part of cement and 2 parts of sand were mixed with 13 per cent. of water, which was at about 70° Fahr. in both cases.

The briquettes were aged under seven different conditions. Those taken as a standard were left in the moulds for 24 hr. after they were made and then removed and stored at a temperature of about 68° Fahr. until broken. The next set was allowed to remain in the moulds in air for 24 hr. when they were removed from the moulds and kept under water until the time for testing, the water being changed every 7 days. Those used in the third group of tests were kept from the outset at a temperature of 22° Fahr., which was the same used throughout the tests for freezing the cement and mortar.

Results of Tests of Cement and Mortar Under Different Conditions of Freezing.

Conditions.	Set in air.	Set under water after 24 hr.	Frozen 6 days and thawed one.	Tested while frozen.	Frozen and thawed 3 times.	Frozen 48 hr. and thawed.	Frozen solid in water and thawed 3 times.	Set in air.	Set under water after 24 hr.	Frozen 6 days and thawed one.	Tested while frozen.	Frozen and thawed 3 times.	Frozen 48 hr. and thawed.	Frozen solid in water and thawed 3 times.
	Neat Briquettes							Mortar Briquettes						
Time of set one week:														
Tensile strength, lb. per sq. in.	200	422	157	244	107	156	235	171	120	57	46	100	127	103
Per cent. of strength of standard	100	211	78.5	122	53.5	78	117.5	100	70.1	33.3	26.9	58.4	74.2	60.2
Increase, per cent.	...	111	....	22	....	....	17.5	...	....	...	...	....	....	....
Decrease, per cent.	...	....	21.5	....	46.5	22	....	...	29.9	66.7	73.1	41.6	25.8	39.8
Time of set two weeks:														
Tensile strength, lb. per sq. in.	285	490	....	200	100	173	255	188	165	...	95	96	140	191
Per cent. of strength of standard	100	171.9	....	70.1	35	60.7	89.4	100	87.7	...	50.5	51	74	101
Increase, per cent.	...	71.9	....	....	....	....	....	...	....	...	...	....	....	1
Decrease, per cent.	...	....	....	29.9	65	39.3	10.6	...	12.3	...	49.5	49	26	....
Time of set twenty-eight days:														
Tensile strength, lb. per sq. in.	428	486	....	250	92	222	285	110	149	...	110	97	100	113
Per cent. of strength of standard	100	113	....	58.4	21.4	51.8	66.5	100	134.4	...	100	88.1	90	101
Increase, per cent.	...	13	....	....	....	....	....	...	35.4	...	...	....	....	1
Decrease, per cent.	...	....	....	41.6	78.6	48.2	33.5	...	....	...	...	11.9	10	....

The fifth group briquettes were alternately frozen and thawed three times, for 12 hr. at a time, and then stored at a temperature of 70° until tested. Those of the sixth group were frozen for 48 hr. directly after being made and then removed to a temperature of 70° until broken. The seventh condition was to place the briquettes in water as soon as they were made and then to put the water in cold storage until it was frozen solid, when it was removed and thawed. This process was repeated three times, after which the briquettes were removed from the water and stored at a temperature of 70° Fahr.

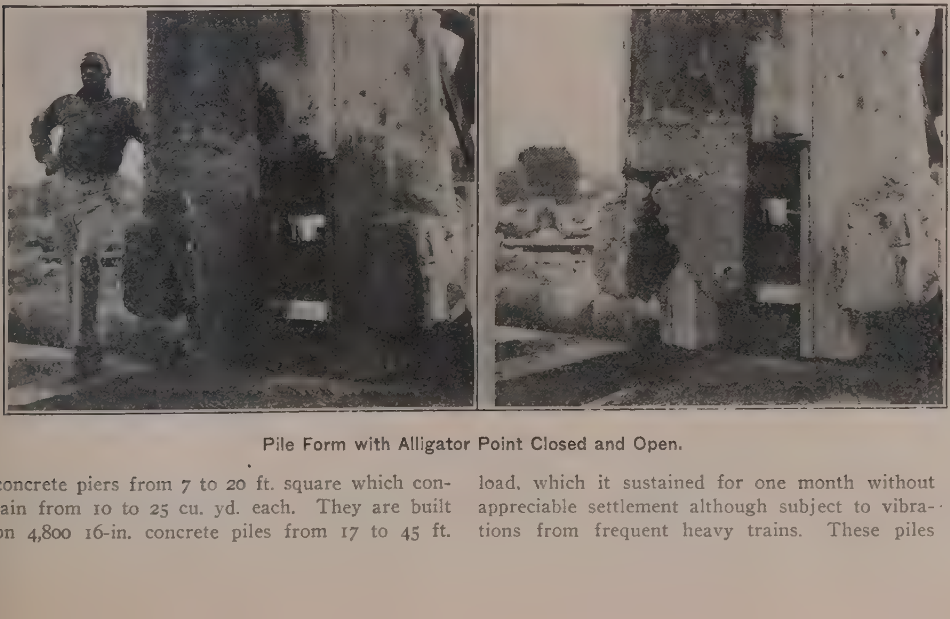
Each result in the table is the average of the ultimate tensile strength of two briquettes, except in the case of the third group, in which but one briquette of neat cement and one of mortar was broken in each instance. The experiments were made as thesis work by Messrs. G. W. Gilmer and C. C. Osterbind under the direction of Prof. L. S. Randolph, M. Am. Soc. C. E., professor of mechanical engineering in the Virginia Polytechnic Institute.

Concrete Pile Foundation for a Large Warehouse.

The thirty-eight warehouses now under construction for the Pittsburg Terminal Warehouse & Transfer Co. are located on the south bank of the Monongahela River between Third, Fourth and McKean Sts., and the Pittsburg & Lake Erie R. R., on the South Side at Pittsburg, Pa. The site is a 30-ft. dry fill of ashes, clay, brick, wire and rubbish, deposited in what was probably the original bed of the river on a stratum of stone grit overlying the rock. Wooden pile foundations would have been perishable; masonry piers of ordinary construction would be costly and require a long time to build. Several different foundation systems were considered; comparative designs and efficiency tests were made, and Simplex concrete piles were finally adopted as most satisfactory for the site and the requirements regarding rapid construction.

Pier with Simplex Pile Foundation Exposed.

The buildings are of fireproof steel-cage construction, and details of the terra-cotta floors were printed in this journal on Feb. 25. The combined structure is about 400 ft. square and eight stories high, and its columns are seated on 340 concrete piers from 7 to 20 ft. square which contain from 10 to 25 cu. yd. each. They are built on 4,800 16-in. concrete piles from 17 to 45 ft. long, loaded to 60,000 lb. maximum, and made substantially like those for the foundations of the Washington Barracks, described in The Engineering Record of Sept. 24 and Oct. 15, 1904. The 1:2:5 concrete was made with 1-in. gravel and about 20,000 bbl. of Dexter Portland cement, mixed quite wet in Smith machines.



Pile Form with Alligator Point Closed and Open.

Cast-iron points were fitted to extra heavy 16-in. steel pipes 40 ft. long and driven by a 3,000-lb. hammer to a penetration of about 5 ft. in the hard stratum overlying the rock. A special hoisting bucket deposited 3 ft. of concrete in the bottom of the pipe, the latter was lifted 2 ft. by a nine-part ⅝-in. steel rope tackle, the concrete was rammed by a suspended 800-lb. rammer, another batch deposited, the pipe withdrawn 2 ft. more, concrete again rammed, and so on until the pile was completed and the pipe removed from the ground. Seven special pile-driving machines were made for this job from oak and Oregon fir, and were equipped with 7x10-in. Lidgerwood hoisting engines. The best record for one machine was thirty-one 35-ft. piles in one day.

A group of four piles in a pier adjacent to the railroad tracks was subjected to a 175-ton test load, which it sustained for one month without appreciable settlement although subject to vibrations from frequent heavy trains. These piles were driven in a preliminary construction competition, and were only 35 ft. long. Adjacent piles driven afterwards to hard bottom were 7 to 10 ft. longer; therefore, it is believed that the test piles had a capacity depending largely on skin friction, and that the longer ones would develop greater capacities. Many of the piles were exposed by excavations, and several were specially exposed by the architect for examination some 20 ft. down. All were found to be perfect, solid monoliths of concrete expanded into the surrounding compressed earth and true to required positions. All were of full diameter, and in many places the ramming had even enlarged the pile to a diameter larger than that of the pile form.

The aggregate length of the piles was 162,000 lin. ft., and they were driven in 76 working days, no time being lost on account of breakdowns of the plant. It was estimated that it would require at least 18 months to have built these foundations with ordinary deep concrete piers and that the probable rentals for the additional time so saved from construction would be greater than the entire cost of the concrete piles, thus making their adoption a matter of importance and advantage.

Seven Special Machines Driving Simplex Piles.

In order to hasten the work special collapsible forms for the piers were built in advance and set as soon as the piles were driven. They were removed after the pier concrete had set and used over and over again for successive piers. During construction the work was frequently inspected by American and foreign engineers and considerable surprise was expressed at the rapidity with which it was executed.

Mr. Charles Bickel, Pittsburg, is the architect of the building. The piles were driven under patents controlled by the Simplex Concrete Piling Co., Philadelphia, Mr. Frank Shuman, president. The contract for the substructure was secured for the Cranford Paving Co., Washington, D. C., by its president, Mr. J. H. Cranford, and the work was executed by that company and by the Foundation Co., of New York, which is also a licensee of the Simplex Co. Mr. George W. Lange was the local manager, and Mr. George H. Beall was the assistant manager for the Cranford Co., and the pile drivers and concrete forms were designed by Mr. Lange. Mr. John Stewart conducted the preliminary competitive test for the Cranford Co.

Since the completion of this contract the "alligator" pile point has been designed by Mr. Constantine Shuman to replace the cast-iron or concrete points formerly used, which remained in the ground. This point is permanently attached to the pipe form and is withdrawn with it. It consists of a pair of semi-cones hinged to the foot of the pipe so as to fit together and form a rigid, water-tight locked point while the pile is being driven down, but the sides automatically separate to the full width and allow the concrete to pass unobstructedly through them when the pipe is raised.

The Measurement of Efficiency in Fire Prevention and Fire Protection.

By a Chicago Architect.

The columns of The Engineering Record frequently contain references to the increased safety provided by superior constructions in which the credits in rates offered by fire insurance companies are quoted as the criterion of excellence. Attention is thus called to a growing appreciation of the economic importance of fire prevention and fire protection, and it is the contention of this article that the importance is now sufficient to warrant the use of a standard of measurement more worthy of credence than the rating schedule promulgated by the fire insurance organization.

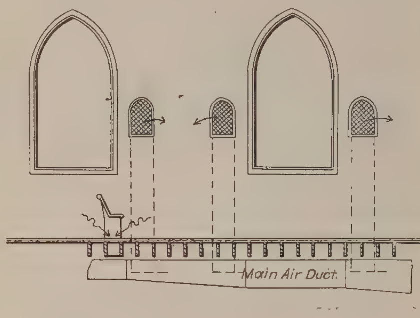
It is conceded by all that the fire waste of this country is abnormal, and that a large portion, amounting to many millions of dollars per annum, is not justified by economic conditions. When the country was new and capital scarce, it was perhaps economic to build cheaply for the moment and rely upon fire insurance to minimize the disastrous effects of fire. But this situation no longer obtains. The means are at hand to extirpate the uneconomic portion of the waste, and capital to install the means is plentiful. The average investor, however, will not so dispose his capital unless assured that the investment will reduce the cost of fire insurance to a profitable extent. Improvements in fire prevention and fire protection are desirable from the viewpoint of the average investor in proportion as they reduce insurance rates. This attitude extends to provisions of like nature in building ordinances. Those entailing considerable expense are invariably fought unless there is convincing evidence that the hazard will be materially lessened.

The elimination of uneconomic fire waste depends, therefore, upon skilled engineering treatment of the problem so that the proper devices shall be selected and their actual earning value made plain to the investor. The engineer needs to know what rate of burning characterizes his proposition as usually handled and what effect upon this rate will result from the adoption of the best available precautions. Can schedule issued by fire insurance companies serve such a purpose?

The fire insurance schedule is not reliable; first, because an absolutely reliable schedule would induce the use of expedients entailing competition and ultimate loss of business; second, because, as in other lines of business, some portions are carried at a loss which is recouped from those more profitable; third, because it would cost a great deal of money to perfect an accurate schedule, and the business system is such that there is no need for the expenditure. Rates are experimental and subject to change. The need for change arises only as forced by competition. If a schedule produces profit from the business as a whole there would be little demand for modifications, even if each individual provision were erroneous considered by itself. It is evident that no schedule subject to such influences can be a reliable guide to the engineer whose business it is to plan so that his client shall obtain the lowest possible rate entailed by strong competition.

Much money has been spent in the investigation of fire losses, so that almost every condition is known which can affect the loss favorably or unfavorably. The more elaborate schedules enumerate all of these particulars and are valuable aids to the engineer who desires to avoid danger from fire. The charges and credits affixed to these merits and demerits are, however, without foundation upon any body of analyzed facts. They are statements of opinion and going prices. They are first promulgated by the working member of a committee, and their fate is determined by debate and majority vote. Some engineers can recall the time when tables of strength were compounded in this manner, but all will concede that the money expended in preparing those in use today has borne economic fruit a thousand fold.

The writer just witnessed the partial collapse of a building erected from his own plans about fifteen years ago. Like thousands of similar buildings in our large cities, it was strong enough to serve its purpose for a hundred years, but could not stand for one hour against the attack of fire. From the engineering point of view, collapse from fire is as culpable as collapse from lack of strength, and as easily preventable. The court of last resort for the investor, however, is the fire insurance schedule, and there it is written that collapse from fire is a business proposition for the investor. Is it not time that the true economic worth of expedients in fire prevention and fire protection were established? Very recently the owner of an old building of ordinary construction was compelled to enclose the passenger elevators with incombustible shafts. Within six months the enclosure formed a large additional item in a loss by fire. If the shafts had been open the fire would certainly have taken that means of spreading, but finding them closed, it did not hesitate to pass right through the floors. Was it worth while to close the shafts in such a building? Is it not worth while to keep a few intelligible records to be able to answer such questions aright? The public spends no end of money for fire alarm systems. Do they earn their salt? What is their absolute value in reducing the rate of burning? These questions are all pertinent and important, and not to be answered with testimonials collected by vendors of devices. It is patent to all that during the past ten years millions have been spent to restrict fire losses, and yet never were fire losses so great.



Scheme of Air Distribution, Trinity Church.

The Electrolysis of gas pipes in one section of Lynn, Mass., in a region where there is considerable traffic on the part of the electric railway, is combatted by reducing the number of services there to a minimum and covering them with earthenware or ordinary sewer pipe which is made as air-tight as possible. It is the belief of Mr. Chas. F. Prichard, of that city, who discussed the measures adopted in this instance in a recent meeting of the New England Association of Gas Engineers, that services which only lasted a short time when exposed to contact with the earth have since given practically no trouble.

Heating and Ventilating Trinity Church Portland, Ore.

A heating and ventilating plant that is of considerable interest as an example of the application of the hot-air furnace with the forced-blast fan and also of the adjustment of the system for the distribution of the air under restrictions imposed by the design of the building itself has been installed in Trinity Church, Portland, Ore. As indicated in the accompanying plans, the scheme in general is to force the fresh air by means of a fan over a battery of large, heavy furnaces, the air being conveyed by galvanized-iron ducts to the spaces to be warmed and ventilated, and to exhaust the foul air at the floor line, a system of exhaust-air ducts delivering the vitiated air to an exhaust chamber provided with an exhaust fan. The exhausting of the air at the floor line was determined on, in view of the considerable height of the church, to keep the warm air, which is discharged into the interior at points 8 ft. above the floor line, continually descending to fill the vacuum which the withdrawal of the air through the floor exhausts tends to create.

Only a part of the church is provided with a basement, this being the part in which the heating apparatus is located. Under the main portion of the church, so-called dwarf walls are run longitudinally over the area to support the floor joists. Owing to the presence of these walls it was not considered advisable to locate a number of small fresh-air registers in the church floor, to secure the desired uniform distribution of air, as this would necessitate a great many small pipes, which, in turn, would mean the cutting of the dwarf walls and consequently the weakening or destruction of the present arrangement for supporting the joists. Two main warm-air ducts were accordingly decided on, one extending along each outside wall and supplying flues in the stone walls of the building.

These two ducts, each 42x30 in. in size, are supplied by a main duct 30x96 in., taken from the top of the brickwork of the furnaces and continued to the wall which divides the excavated portion of the basement from that which is not excavated. Each subdivision supplies nine vertical heat flues, which, located, as stated, in the stone walls of the building, rise to a height of 8 ft. above the floor line, terminating at this point with heat screens. The flues are 24x12 in. in size with the exception of the two at the extreme end, which are 48x12 in.

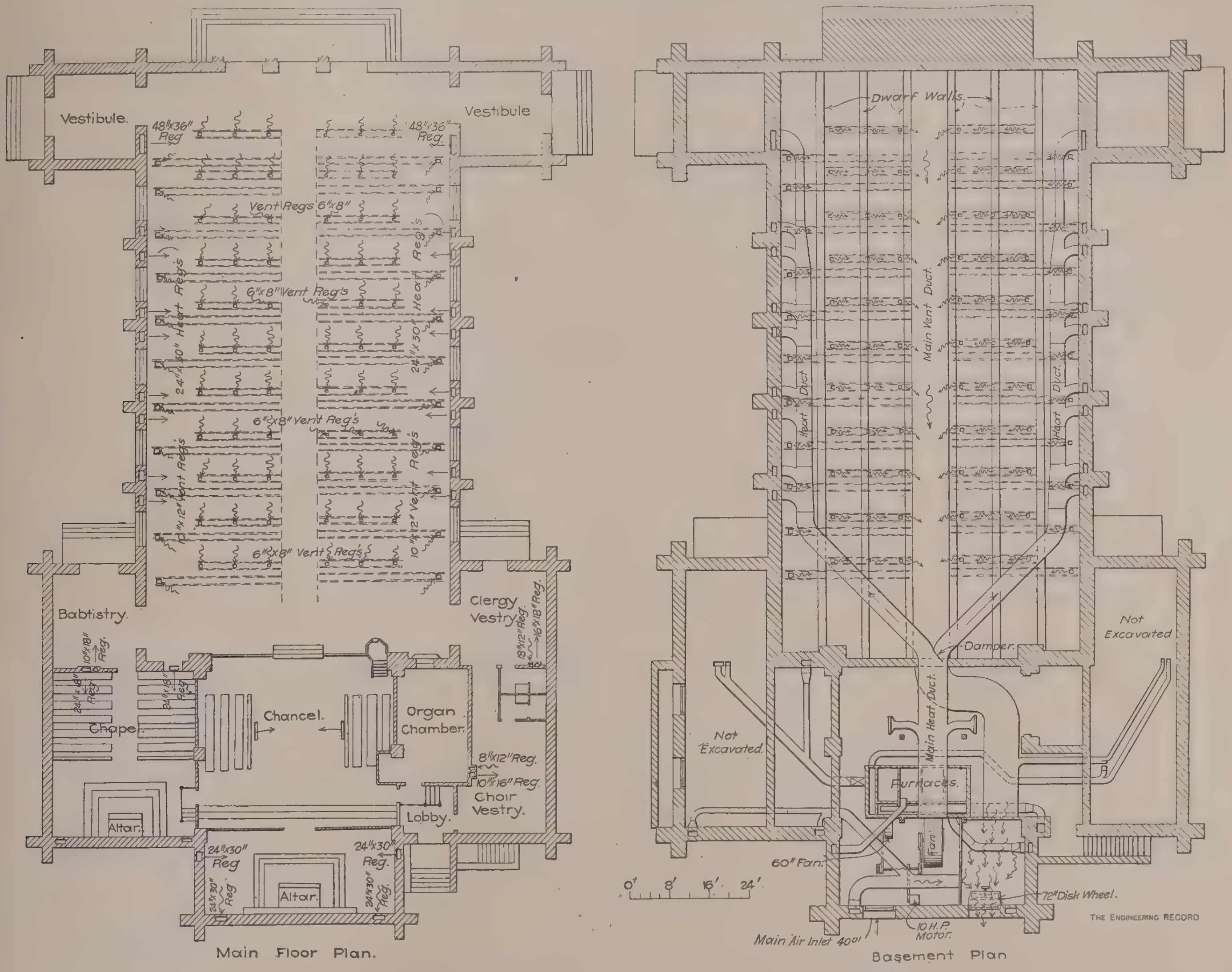
For the eduction of the air, a number of registers are located in the floor, as shown in the plans. These registers are placed over the space between floor joists, and the joists are boxed in at the bottom and all bridging removed so as to provide a free area for the passage of air to the main vent duct, which is formed by the two center dwarf walls. This main duct, at the point where it enters the furnace room, is in turn continued by a 84x36-in. galvanized-iron duct to the main exhaust chamber, wherein is located a large disk fan, discharging the vitiated air into the atmosphere through the window opening at which it is placed. The vent registers in the floor, the sizes of which are indicated on the plans, are proportioned to reduce the velocity of air flowing through them to as low a point as practicable to eliminate the possibility of drafts about the feet of the occupants. The seats of the auditorium are located so as to bring the vent registers under them, as shown in the detail sketch.

Small rooms of the church, such as the chapel, clergy room and vestry room, are heated from air flues located in their walls and ventilated by registers and flues drawing from the floor line. The vent flues connect into galvanized-iron ducts in the basement which join the main vent duct leading to the exhaust chamber. The heating of the chancel at the rear of the church is accomplished by special flues located in the walls, in the same manner as in the auditorium of the church. Two long narrow registers are located in front of the choir benches to ensure the heating and ventilation of this portion of the chapel. The interesting provision in connection with the heating of the rooms at the rear of the church is the arrangement made for heating independent of the main auditorium. This is done by means of a small fan which is connected to one of the furnaces of the battery in such a manner that the latter may be entirely cut off from the others.

The heating apparatus in detail is as follows: There are four heavy cast-iron furnaces, of a special form known as the McPherson furnace used for this class of work. The main fan is a 160-in. full-housing steel-plate fan, running at a speed of 145 r.p.m., and the smaller fresh-air fan is 60 in. in size, of the same pattern, running at 350 r.p.m. Both fans are equipped with extra wide pulleys and are belted to a countershaft on which are mounted tight and loose pulleys. The counter-shaft is belted in turn to an electric motor of 15 h.p. The exhaust fan is a 72-in. disk wheel, operating at a speed of 200 r.p.m. from a 5-h.-p. motor.

No attempt will be made in the present case to discuss the design in detail, as the sizes and operating speeds of the fans are given and the leading dimensions and distribution of the ducts and flues are shown in the illustrations. It may be stated, however, as a matter of check, that the plant comprehends the delivery of about 30,000 cu. ft. of air per minute into the church, and 4,000 cu. ft. per minute by means of the small fan to the small rooms at the rear of the church. The main fresh-air duct is porportioned on a velocity of 1,500 ft. per minute and the main vent duct on a velocity of 1,000 ft. per minute. It is of further interest to point out that both the main air duct and all the small warm air ducts are fitted with mixing dampers and are so connected to the furnace brickwork that warm air from the furnaces or tempered air may be introduced into the auditorium at will.

The building was designed by Mr. D. C. Lewis, architect, of Portland, and the heating and ventilating plant by Mr. Chas. J. McPherson, of the W. G. McPherson Co., engineers of that city.



Plans Showing Fan-and-Furnace System of Heating, Trinity Church, Portland, Ore.

Building the Alfreton Tunnel.

The second Alfreton tunnel, built in widening the main line of the Midland Railway in Derbyshire, England, is 90 ft. from the original tunnel, and ½ mile in length. Owing to the heavy cutting required at both approaches, tunnel operations were carried on from five shafts sunk on the center line. In a paper by Mr. E. F. C. Trench, read before the Institution of Civil Engineers, it is stated that the full cross-section of the tunnel was driven in both directions from each shaft until the adjacent working faces had approached within about 125 ft. of each other, when a small heading was driven through in order that the alignment and levels might be checked. In no case was there an appreciable error, although an ordinary 5-in. transit theodolite was used in running the center line. The tunnel is brick lined, with a thickness of the tunnel ring of 2 ft. 3 in., except for a few lengths, in which it is 2 ft. 7½ in., and in the shaft lengths, where it is 3 ft. thick. The face walls of the portals were built with a batter of 1 to 6, and the tunnel given a bell mouth by increasing the length of its vertical axis 2 ft., in order to bring the courses of brick in the tunnel ring normal to the batter of the face wall. Hoop-iron straps were placed between the brick courses at each face to increase the longitudinal strength of the tunnel barrel at these points. Considerable water was encountered in driving the tunnels, which was removed from the working faces in earthenware pipes laid below the invert of the tunnel. The permanent drainage is a 2-ft. brick culvert built on the tunnel invert. The vertical shafts are drained by earthenware pipes built in behind the brick lining of the shafts and tunnel and discharging into the tunnel at rail level. The water which accumulates around the shaft lining is collected and led to the drains by brick "garlands" encircling the shaft linings just below the water-bearing strata. The track in the tunnel has 100-lb. rails, which were painted with four coats of red lead paint before laying.

Electrolytic Action on Lead-Lined Service Pipe in a water-works service connection crossing under an electric railway track in Reading, Mass., so badly disintegrated the iron in one place, according to the annual report of Mr. Lewis M. Bancroft, superintendent of the water-works, that the thin lead lining alone remained.

Book Notes.

Books printed for private circulation are not customarily reviewed, yet an exception to this rule must be made in the case of two beautiful volumes entitled "Mechanical and Electrical Inventions," in which the late Ernest Kempton Adams dedicated to the public the work of one of the most brilliant young thinkers the country has produced. It is customary to speak with respect of the men who have won success in the face of early poverty and lack of education, but the career of Mr. Adams taught the equal or even greater measure of applause due to the man of frail constitution, guarding himself against every unnecessary exertion, who accomplishes many things. In these books are descriptions of 241 inventions, few of them patented, covering an astonishing range of subjects. They are illustrated by reproductions of the author's drawings, which were famous for their high quality even during his undergraduate days at Columbia. It is difficult to mention these volumes without making statements which will appear fulsome to those unacquainted with the gentle, deeply thoughtful character of their author. It is to be hoped, however, that all the readers of this journal may at some time have an opportunity of examining this printed record of one side of a brief life that deserves to be commemorated in a more public manner than by the private circulation of two books, however sumptuous their details.

The eighteenth annual report of the Commissioner of Labor has been issued by the Department of Commerce and Labor, and is an elaborate analysis of the cost of living of 25,440 workingmen's families in the principal industrial centers of the United States. While the data of expenditures were being collected, a thorough canvas of the same localities was made for information as to the course of retail prices. This latter investigation showed that the range of fluctuations in the retail prices of stable articles of food had been 15.4 per cent. during 1890-93 inclusive, although the wholesale prices had varied 37.2 per cent.

The 516 pages of the "Scientic American Reference Book" contains data and pictures relating to such an enormous variety of subjects that it is impossible to do more than group them under very general heads as follows: Shipping and yachts, armies and navies of the world, railroads, population, education and reading matter, telegraphs and telephones, patents, manufactures, mining, government data, international bureaus, mechanical and chemical data, astronomy, weights and measures. The book was compiled by Albert O. Hopkins and A. Russell Bond, and gives the information, not readily available elsewhere, which the editor of the "Scientific American" is asked to furnish to his correspondents. (New York, Munn & Co., $1.50.)

A Manual of Mining. By M. C. Ihlseng and Eugene B. Wilson. Fourth revised and enlarged edition. New York, John Wiley & Sons; cloth, 9 x 6 in,. 739 pp., $5.

This book has shown by its continued popularity that it answers the requirements of many who desire to study the general features of mining engineering. The first edition was based on lectures delivered at the Colorado School of Mines in 1880-88, and was mainly devoted to the methods of mining ores. The new edition has been enlarged to include all phases of coal mining.

The volume is in two parts, one general and the other on details. The first explains the work of the mining engineer in prospecting and developing properties, and describes the methods of mining, the types of steam and electric power plants generally used, the various classes of hoisting machinery and underground haulage systems, the supply and uses of compressed air, illumination, pumping plants, the gases encountered in mines and the methods of ventilating in successful use. The second part of the book is on practical mining. The subjects discussed are shafts, sinking in running ground, timbering rooms and galleries, driving drifts and tunnels, drilling and boring machines, miners' tools, channelers and coal cutters and blasting. The comprehensive nature of the contents are well shown by this summary, while the merits of the treatment are better indicated by the popularity of previous editions than by more extended comment.

Cement and Concrete. By Louis Carlton Sabin. New York, McGraw Publishing Co., cloth, 9 x 6 in., 517 pp., $5.

About everybody who has lately written a book on concrete has found it necessary to refer to the very complete tests of cement and concrete made in connection with the construction of the Poe lock at Sault Ste Marie, under the general direction of the late Gen. O. M. Poe and Mr. E. S. Wheeler. These investigations, which remain unrivaled for scope and thoroughness, form the fundamental matter in this book, which has been rounded out with carefully selected data from other sources into a thoroughly comprehensive and scientific treatise. The author's connection with the Sault Ste. Marie work and other important concrete construction for government purposes gave him access to detailed information which is denied to most engineers, and the value of the book is correspondingly increased.

In the first part he gives such a general discussion of cement manufacture as will be of assistance to the user in determining the probable causes of defects he may occasionally find in this material.

In the second part, on the properties of cement and methods of testing, Mr. Sabin states for each test the object sought in making it, the methods usually adopted and the conditions which will vary the result. This section of the book, particularly the general conclusions on various tests, is the result of a very thorough study of the things which affect the results of cement tests and of the significance of these results, made during five years of personal supervision in the laboratory of the work of testers. The chapter on tensile tests is probably based on the most complete study of the subject ever made in this country.

The chapters on sand, the preparation and cost of mortar, the aggregate, and the methods and cost of concrete making probably form the most complete analysis of these closely related subjects that has yet been attempted in the United States. The chapter on the tensile and adhesive strength of cement mortar and the effect of variations in treatment is probably the most valuable section of the book, because it covers many points not previously investigated fully. The sixty tables in this chapter, largely based on original tests, give data on such disputed subjects as the effect of mixing lime and plaster with Portland cement, the influence of clay and sawdust, the use of cement in freezing weather, and the adhesion of cement and mortar to stone, brick and steel. This chapter is supplemented by two giving comprehensive statements of the important facts concerning the compressive and transverse strengths of mortar and concrete.

The closing part of the book explains the uses of mortar and concrete, and is characterized by an absence of unnecessary detail about trivial matters. The 146 pages of this section start with an explanation of the construction of timber moulds for heavy concrete work and the methods of depositing concrete in both open and submerged positions. The information on concrete finish is of special value and so is the discussion of colors for concrete. The treatment of reinforced-concrete beams is simple and adequate, and takes no account of the tensile strength of the concrete. Tables are given which make it easy to design a beam without recourse to any empirical formulas, which are only approximately correct unless accompanied by a voluminous table of constants. The uses of concrete in buildings, walks, pavements, curbs and gutters, street railway foundations, sewers, subways, reservoir linings, bridge substructures, piles, arches, dams, locks and breakwaters are taken up in a concise yet comprehensive way. Care has been taken to point out any special difficulties to be met and precautions to be taken in the construction of these classes of works, and many examples of cost are given.

The special merits of the author's method of handling his subject are four-fold; first, his conclusions are based on thorough experimental investigations; second, the results of enough tests, usually long-time, are given to support his statements; third, the branches of the subject are developed in logical order; fourth, many detailed data of costs are given. It should be added that the book is the best-manufactured engineering manual that has been published for a long time.

Letters to the Editor.

AREAS OF CIRCULAR SEGMENTS.

Sir: The equation which Mr. J. A. Macdonald gives for areas of circular segments in your number of March 25 is very frequently put in the form of

$$A = rs\left(\frac{2}{3} + \frac{r^2}{2s^2}\right)$$

In this form, r is the mid-ordinate and s is the chord. This equation is only approximate, and does not give accurate results when r/s approaches 0.50, or when the segment approaches a semicircle. When $r/s = 0.40$ the above equation becomes $A = 0.7467$ rs instead of 0.7455 rs, and when $r/s = 0.50$, it becomes 0.7917 rs instead of 0.7854 rs, the correct value.

Yours truly,

New York, March 27. S. D. Bleich.

REINFORCED CONCRETE AND STEEL BEAMS.

Sir: Recently in designing some re-enforced concrete beams in accordance with the formula suggested by Professor Talbot in The Engineering Record of Aug. 13, 1904, the writer observed a very uniform relation between re-enforced concrete and ordinary I-beams. This relation may be expressed as follows:

In a re-inforced beam 24 in. wide and of any given depth, the weight of re-inforcement is 40 per cent. of the weight of a steel I-beam of same depth and same strength. The formula referred to is as follows:

$$M = ASd\ (0.9 - P/15) \text{ or}$$
$$\text{section modulus} = (0.9 - P/15)\ A\ d,$$

in which $P =$ percentage of re-inforcement; $A =$ area of re-inforcement, and $d =$ depth above center of steel.

To illustrate: A 3-in. 5½-lb. I-beam has a modulus of 1.7; from the above formula, a 3 × 24-in. concrete beam with 0.67 sq. in. of steel has the same modulus; the weight of this re-inforcement = 2.27 lb., which is 41.4 per cent. of the I-beam.

In like manner a 24x24-in. concrete beam with 9.12 sq. in. of steel has the same modulus as a 24-in. 80-lb. I-beam; in this case the ratio is 38.8 per cent. It will be found for intermediate depth the ratio is between the figures given here and that the average is very nearly 40 per cent. Yours respectfully,

R. H. Brown,
Chf. Eng., Eastern Bridge Co.

CURRENT NEWS SUPPLEMENT

APRIL 1, 1905.

RY OF NATIONAL ENGINEERING SOCIETIES.

AN SOCIETY OF CIVIL ENGINEERS. Sec-
as. Warren Hunt, 220 West 57th St.,
. Annual convention, Cleveland, June
ext meeting, April 5; paper by H. C.
on a new swing bridge at Copenhagen.

AN SOCIETY OF MECHANICAL ENGINEERS.
F. R. Hutton, 12 West 31st St., New
ext meeting, New York, April 25,
; last reunion of the season, to which
invited; paper by Mr. G. C. Hen-
liamond tools.

AN. INSTITUTE OF ELECTRICAL ENGI-
ecretary, Ralph W. Pope, 95 Liberty
York. Annual convention, Asheville,
ne 19-23. Next meeting, at Carnegie
il 28; four papers on meter subjects.

AN INSTITUTE OF MINING ENGINEERS.
R. W. Raymond, 99 John St., New

AN INSTITUTE OF ARCHITECTS. Secre-
n Brown, Washington, D. C.

TION OF ENGINEERING SOCIETIES. Sec-
hn C. Trautwine, Jr., 257 South
., Philadelphia, Pa.

AN SOCIETY OF HEATING AND VENTI-
GINEERS. Secretary, W. M. Mackay,
St., New York.

N SOCIETY OF CIVIL ENGINEERS. Sec-
ment H. McLeod, 877 Dorchester St.,

FOR THE PROMOTION OF ENGINEERING
. Secretary, Prof. M. S. Ketchum,
of Colorado, Boulder, Colo.

N SOCIETY FOR TESTING MATERIALS.
Prof. Edgar Marburg, University
lvania, Philadelphia, Pa.

N SOCIETY OF MUNICIPAL IMPROVE-
ecretary, George W. Tillson, Room 12,
Building, Brooklyn, N. Y.

ION OF RAILWAY SUPERINTENDENTS OF
ND BUILDINGS. Secretary, S. F. Pat-
cord, N. H.

N RAILWAY ENGINEERING AND MAIN-
F WAY ASSOCIATION. Secretary, L. C.
52 Monadnock Block, Chicago.

N WATER-WORKS ASSOCIATION. Sec-
M. Diven, Charleston, S. C. Annual
at West Baden, Ind., May 8 to 12.

N FOUNDRYMEN'S ASSOCIATION. Sec-
hard Moldenke, P. O. Box 432, New

BUILDERS' ASSOCIATION OF THE
ATES. Secretary, J. L. Lyle, 39 Cort-
New York.

ERICAN RAILWAY ENGINEERING D MAINTENANCE OF WAY ASSOCIATION.

SIXTH ANNUAL CONVENTION, CHICAGO,
MARCH 21-23.

vention opened with the address of
Hunter McDonald, who reviewed
of the Association during the past
and suggested general lines for fu-
opments. The report of Secretary
wed that the finances of the Asso-
in sound condition and that the
at the present time numbers 463.
ts of the various committees were
up according to the published pro-
order of consideration having been
by priority of publication of reports
nthly Bulletin.
I. O. Walker, of the Committee
n Bridges and Trestles, stated that
been a meeting with a committee of
rn Lumbermen's Association with a
uring consistency in the specifications
was proposed to present to the
. After detailed discussion and re-
following specifications for bridge
piling were adopted by the Associa-
ommittee being instructed to present
n a more condensed form at a future
The Secretary of the Lumbermen's
was present at the convention and
the discussion. Particular attention was given to the matter of availability of timber supply from various parts of the country. The committee presented preliminary recommendations in regard to ballasted deck trestles constructed from creosoted timber, and a resolution was passed asking for a more extended and definite report on this subject at the next convention.

SPECIFICATIONS FOR BRIDGE TIMBER.

Guard Rails.—Long Leaf Yellow Pine or Douglas Fir.—To be cut from sound, live trees and sawed full size and length, rectangular in section and out of wind. It shall be close-grained and free from wind shakes, unsound knots or knots over 2 in. in diameter, or any defect that will impair its strength or durability. One face shall show all heart, the other face and both edges shall show not less than 75 per cent. heart measured across the surface anywhere on the piece.

Bridge Ties.—Long Leaf Yellow Pine and White, Post and Burr Oak.—To be cut from sound, live trees, sawed full size and length, rectangular in section, and out of wind. Timber shall be close-grained, free from wind shakes, unsound knots, or knots over 1½ in. in diameter, or any defect that may impair its strength or durability. Sap will be allowed on any or all corners, but each of the four sides shall show at least 75 per cent. heart, measured across the side anywhere on the tie. Sound knots not more than 1½ in. in diameter will be allowed if so located that they will not impair the strength of the tie.

Douglas Fir.—Shall be full size and length and sawed rectangular and out of wind. They must be close-grained and free from wind shakes, large, loose or unsound knots or decayed streaks, and must show at any point in their length not less than 85 per cent. heart. Knots must not show over 2 in. in diameter, as measured on the surface, and must not be in groups.

Stringers.—Long Leaf Yellow Pine.—To be cut from sound live trees and sawed full size, rectangular in section and out of wind. They must be close grained and free from wind shakes, large or unsound knots, pitch seams, decay or defects that will impair their strength or durability. None of the four sides to show less than 85 per cent. heart measured across the sides anywhere in the length of the stick. Sound knots will be allowed, but not in groups nor so located as to impair the strength of the piece.

Douglas Fir.—Shall be sawed rectangular in section and full size and length. Straight close grained and cut from sound live trees and must be free from shakes, large, loose or rotten knots, pitch seams, pitch pockets, or any other defect in the grain which would impair the strength of the piece. Sap wood, if sound, will be permitted on two corners of the stick, but at least 85 per cent. of any face and 70 per cent. of any edge shall show all heart, measured across the surface at any point on the length of the stick. Sound knots less than 2 in. wide will be permitted if not less than 4 in. from the edge. Knots must not be in groups, and in no case will they be allowed on any edge of any stick.

Caps and Sills.—Long Leaf Yellow Pine, White, Post and Burr Oaks.—Shall be cut from sound live trees, sawed full size and length and square in section. Timber shall be close grained and free from wind shakes, large or unsound knots, decay or any defects that will impair its strength. Solid knots will be allowed, but they must not be so located as to impair the strength of the stick. The opposite or bearing faces of the caps shall show at least 85 per cent. heart and the other two sides shall show 75 per cent. heart, measured across the face anywhere in the length of the stick.

Douglas Fir.—Timber shall be sawed full size and length, rectangular in section and out of wind, close grained and free from wind shakes, large, loose or unsound knots, decayed streaks, or hollow butts. Sap wood if sound will be allowed, but each face shall show at least 75 per cent. heart, measured across the face anywhere in the length of the stick. Sap must not exceed two (2) in. in width at any corner. Knots must be sound and not over 3 in. in diameter measured on surface of stick and must not be in groups.

Posts.—Long Leaf Yellow Pine, White, Post and Burr Oaks, Douglas Fir.—Timber shall be cut from live sound trees, sawed full size and length and out of wind. It shall be free from shakes, large or unsound knots or any defect that will impair its strength or durability; each face must shown 66 per cent. heart, measured across the face anywhere in the length of the stick. Sound knots will be allowed up to two (2) in. in diameter, measured on surface of the stick, but no knots will be permitted in the corner of the post. One-inch wane will be allowed on two corners half the length of the stick.

Longitudinal Struts or Girts.—Long Leaf Yellow Pine, Douglas Fir.—Timber to be cut from sound live trees and full size and length, rectangular in section and out of wind. It shall be close grained and free from shakes, rot and any defect that will impair its strength or durability. One edge shall show all heart; the other three sides shall show 85 per cent. heart, measured across the face anywhere in the length of the stick.

Longitudinal X Braces, Sash Braces and Sway-Braces.—Long Leaf Yellow Pine, Douglas Fir, White, Burr or Post Oak.—Timber to be cut from sound live trees, sawed full size and length and rectangular in section, close grained and free from wind shakes, large or unsound knots or other defects that will impair its strength for the above pieces, each face to show 66 per cent. heart, anywhere in the length of the stick; no restrictions as to sap on edges.

Piles.—White, Post or Burr Oak.—Piles shall be cut from growing trees, free from wind or heart shakes, large or unsound knots, decay or other defects that impair the strength or durability of the pile. Only butt cuts, cut above the ground swell of the tree, will be accepted. Bark shall be peeled off, and knots trimmed smoothly to the body of the tree. After peeling and trimming, piles shall be reasonably straight and uniformly tapering.

Piles shall be of close, firm grain and with sap ring not over 2 in. in thickness. They shall be not less than 12 in. in diameter, 6 feet from the butt, and when less than 30 ft. in length, shall be 10 in. in diameter at the point; 30 ft. to 39 ft. long, 9 in., and 40 ft. long and over, 8 in. at the point. Square piles shall be of timber squared throughout their entire length, smoothly hewed and of the following dimensions: Large end not less than 14 in. or more than 16 in.; small end for piles 30 ft. long and under, 10 in. square; 30 ft. long to 40 ft. long, 9 in. square; 40 ft. long and over, 8 in. square. A pile will be considered straight if it has not more than 2 in. deviation from the straight in 20 ft., 5 in. in 30 ft., or 8 in. in 40 ft., or 10 in. in 50 ft., but no short crooks will be allowed.

Norway and Tamarack.—Piles shall be cut from sound live trees, free from wind or heart shakes, large or unsound knots, decay or other defects that impair the strength or durability of the pile. Only butt cuts, cut above the ground swell of the tree, will be accepted. Bark shall be peeled off, and knots trimmed smoothly to the body of the tree. After peeling and trimming, piles shall be reasonably and uniformly tapering. Piles shall not be less than 14 in. nor more than 18 in. in diameter at the large end. Piles less than 36 ft. long shall be not less than 10 in. in diameter at the small end. Piles over 36 ft. long shall be not less than 9 in. in diameter at the small end.

Long Leaf Yellow Pine.—Piles shall be cut from sound live trees, straight, close grained and free from wind or heart shakes, large or unsound knots, decay or other defects that will impair the strength or durability of the pile.

No doubtful grades of yellow pine will be accepted. Piles shall be hewed square, except that 1 in. wane will be allowed on two corners half the length of the pile. They shall not be less than 12 in. nor more than 14 in. at the large end and not less than 8 in. square at the small end. Piles having a bend not exceeding 4 in. in 20 ft. 6 in. in 30 ft., and 8 in. in 40 ft. or over, will be considered straight. No short crooks allowed. Square piles must be hewed smoothly without deep score hacks. Piles shall show at least 75 per cent. heart on face anywhere in their length.

Red or White Cedar.—White cedar piles shall be not less than 14 in. in diameter at the large end and 9 in. at the small end, if less than 30 ft. in length; when over 30 ft. in length they shall be not less than 8 in. in diameter at the small end. Unsound butts will be accepted if the defect is not more than 4 in. in diameter. There must be 5 inches of sound close grained wood all round the defect. Red cedar piles must fulfill above conditions, but shall not be less than 12 in. in diameter at the butt.

Piles shall be straight and have knots trimmed smoothly to the body of the tree. Piles having a bend of 4 in. in 20 ft., 6 in. in 30 ft. and 8 in. in 40 ft. or longer, will be considered straight.

Oregon Fir.—All piles to be made from straight, sound, live red or yellow Oregon Fir, free from shakes or unsound knots, and showing not more than 1½ in. of sap at the small end. Piles shall show a gradual taper from end to end. Ends must be cut off square, all bark peeled off and all branches and knots trimmed off smoothly. Piles under 40 ft. in length must be not less than 10 in. in diameter at the small end and not less than 14 nor more than 18 in. in diameter at the large end. Piling over 40 ft. in length shall be at least 8 in. in diameter at the small end and from 16 to 22 in. in diameter at the large end. Piles will be considered straight when they have a gradual bend of 2 in. in 20 ft., 3 in. in 30 ft., 4 in. in 40 ft., or 5 in. in 50 ft. or over.

Cypress Piles.—Cypress piles shall be cut from sound heart, red or swamp cypress, straight, close grained, free from unsound knots, decay or large peck timber or any defect that would impair the strength or durability of the timber. Piles shall be squared throughout their whole length and smoothly hewed. No piles to be more than 16 nor less than 14 in. square at the large end. Piles less than 30 ft. long shall be 10 in. square at the small end. Following bends will be considered straight: 2 in. in 20 ft., 3 in. in 30 ft., 4 in. in 40 ft., 5 in. in 50 ft. Piles shall be free from sap.

Foundation Piles.—Piles for foundation that will always be completely submerged and piles for cofferdams, falsework and other temporary work, may be of red oak, hickory, elm, gum or any sound timber that will stand driving and need not be peeled. They must not show crooks. Such piles shall be not less than 12 in. nor more than 16 in. in diameter at the large end and at least 9 in. in diameter at the small end. The following bends will be considered straight: 2 in. in 20 ft., 3 in. in 30 ft., 4 in. in 40 ft., 5 in. in 50 ft.

At the evening session the report of the Committee on Rails was made the special order of business. Chairman Webster read several communications discussing the subject of rail deterioration, and presenting interesting and important data tending to show that the quality of the rail is affected more by the physical treatment than by the chemical composition of the metal. The oral discussions at this session were joined in by eminent users and manufacturers of steel rails. It was pointed out that rail furnished in recent years has grown steadily worse, and a demand was made that some radical step be taken to improve the grade of rails supplied to the consumer. The adopted drop test was voted on and the Association decided to stand by the heights adopted in 1893. It was also voted to insist upon taking the test piece for the drop test from the top of the ingot to detect the influence of segregation and other evils, such as piping.

The report of the Roadway Committee was devoted chiefly to slight revisions of the general specifications for construction adopted in previous years. A number of important features were fully discussed with a view to publishing the report in full in the forthcoming "Manual of Recommended Practice."

The report of the Committee on Iron and Steel Structures consisted of a complete set of specifications for railway bridge work. The discussions of this report were unusually spirited, being joined in by many well-known railway and consulting bridge engineers. The matter bringing about the chief controversy was the treatment of impact. The committee recommended the adoption of the impact formula used by the American Bridge Co., proposed by Mr. C. C. Schneider, President Amer. Soc. C. E., a member of the Committee on Iron and Steel Structures of the Maintenance of Way Association. As a result of this discussion the Association voted to receive the first part of the report relating to design as a progress report, but the second part relating to material and workmanship was formally adopted for publication in the "Manual."

The report of the Committee on Signaling and Interlocking presented eleven conclusions on interlocking signals and four conclusions relating to the telegraph and controlled manual, block signals, all of which were adopted.

At the concluding session brief consideration was given to the reports of several committees with special reference to the publication of the more important features in the "Manual." These included the reports of the committees on Yards and Terminals; on Water Service; on Records, Reports and Accounts; on Buildings; on Masonry; on Ballasting; on Track; on Ties; and on Signs, Fences and Cattle Guards.

The action on the Masonry Committee Report included the approval of the specifications for Portland and natural cement adopted by the joint committee with the American Association for Testing Materials and the Association of Cement Manufacturers.

The report of the Committee on Buildings included: (1) a standard form of contract for railroad buildings; (2) recommendation relative to one general waiting room or separate waiting rooms in local passenger stations without reference to separate waiting rooms for colored people; (3) recommendations relative to the requirements of a modern roundhouse.

The standard contract form is similar to the uniform contract form adopted and recommended for general use by the American Institute of Architects and by the National Association of Builders, revised and modified to meet the requirements of railroad companies.

In support of the depot ground plan scheme shown in Figs. 1, 2 and 3, the committee offered the following reasons:

(1) It allows the general waiting room to be properly proportioned.

(2) It permits proper development of a retiring room for women with private entrance to their toilet.

(3) It readily admits of the other rooms being properly proportioned.

(4) It allows ease of access from agent's office to the trains, to the baggage room and to the waiting room.

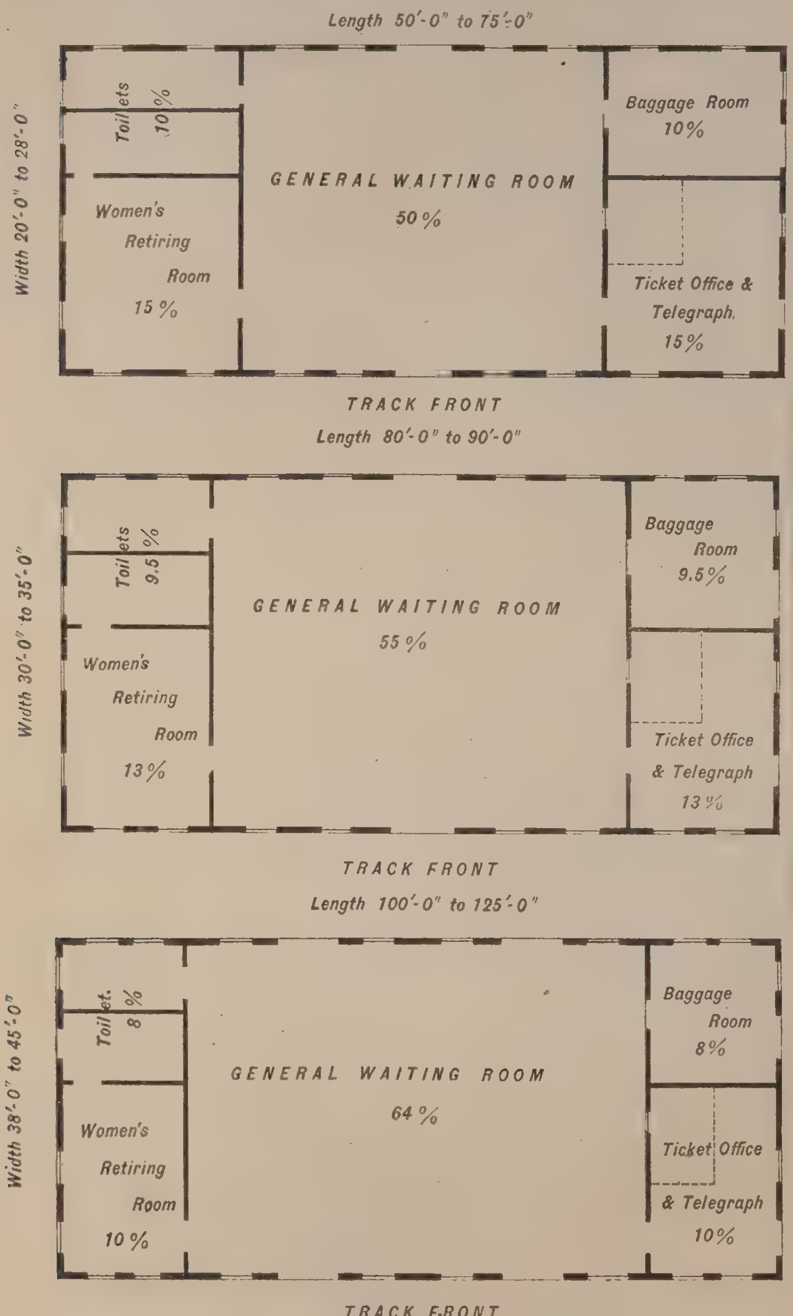
(5) It allows the ticket office to be used for a registration (|bgkqj cmfwyp shrdlununupunu registering or an "O. S." office.

(6) It admits of the station being contracted in size without detriment of facilities.

(7) Economy of heating.

(8) It admits easily of varied treatment architecturally.

Progress reports were made by the special Committee on Classification of Track and by the Committee on Economic Theory of Railway Location. The following officers for the ensuing year were elected: H. G. Kelly, president; A. W. Johnston, vice-president; L. C. Fritch, secretary; W. S. Dawley, treasurer, and J. B. Berry and W. McNab, directors.



STANDARD PLANS, AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.

A NEW CONCRETE MIXER.

A new concrete mixer, called the Autometric by the makers, the Bonnot Co., of Canton, O., is shown rather unsatisfactorily in the accompanying illustration. Its purpose is to duplicate the successive stages of hand mixing of the best character, and to surpass such mixing in thoroughness, continuity of operation and uniformity of proportions. This is accomplished by an automatic supply of the raw materials in definite proportions, by mixing the materials dry before water is added, and by using an apparatus so large that by the time the concrete reaches the discharge end it is fully prepared for use.

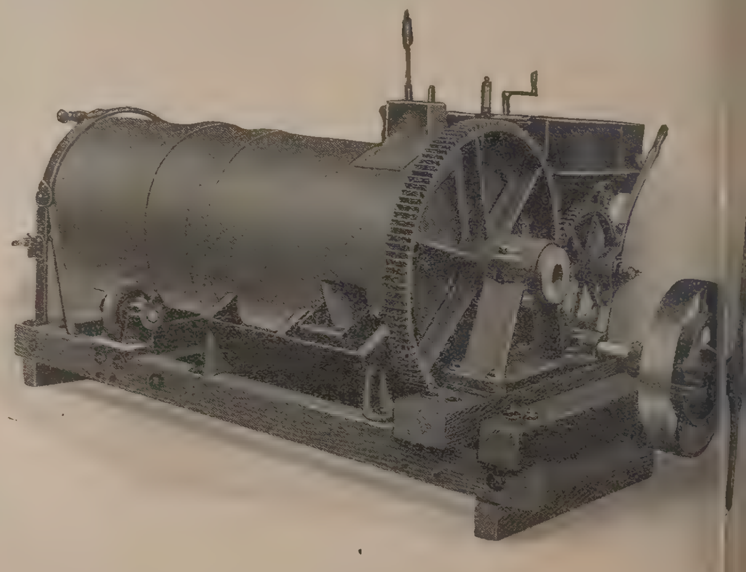
The mixing is done in a revolving cylinder, supported by a hollow shaft at one end and on friction rollers near the other end. It is driven by a direct-connected engine or by belt, and its continuous operation requires only a small amount of power; this is because it is unnecessary to overcome great inertia every few minutes, as is the case with mixers which are stopped and started at frequent intervals.

At one end of the cylinder is a hopper partitioned off into three bins of sizes approximately proportional to the volumes of the ingredients. These materials fall by gravity into troughs below the cylinder and shaped to fit its surface. Three sets of buckets of known capacity, one set for each of the ingredients, are attached to the outer surface of the cylinder. As the latter rotates, these buckets pass through the troughs, fill with materials and, as they approach the top of their circuit, discharge by gravity into the interior of the cylinder. A device for striking off the surplus material in each bucket makes the measurement accurate. Blanks are furnished for substitution in place of as many buckets as seem undesirable, and provision is made for varying the capacity of the individual buckets. In this way the proportions of the concrete can be adjusted accurately.

When the materials fall from the buckets into the cylinder they are trapped against falling out again and are moved along by deflecting blades within the cylinder. Under the action of these blades the materials are mixed dry until they reach the zone where the water is added. This is supplied through a pipe which passes through the hollow shaft, and the amount can be regulated by a valve outside the machine.

The wet mixing is done by blades on the interior of the cylinder, which pick up, divide and drop the ingredients until they are completely commingled by the time they reach the end of the machine. A tilting discharge chute projects into the interior at this end and catches the product as it drops from the highest point of its last revolution and discharges it about 28 in. above the ground. By changing the inclination of the chute, the concrete is allowed to drop to the bottom of the cylinder and its discharge is thus stopped without checking the revolution of the cylinder.

These machines are regularly made with capacities of 30, 60 and 100 cu. yd. in 10 hr., although other sizes can be made on special orders. By speeding the machines, their capacity can be increased, although the ratings mentioned represent the average outputs under ordinary conditions. Machines rated at 60 yd. or less are provided with detachable steel hoppers, while for the larger mixers wooden hoppers must be built. If the bins are plied with materials and the concrete is as fast as produced, one man will be for running the mixer.



THE AUTOMETRIC CONCRETE MIXER.

IRRIGATION IN TEXAS.

Texas has at present about 300,000 irrigated land, of which 75,000 acres ed in ordinary crops and 225,000 acre For years stock raising has been the dustry of the arid and semi-arid portic State, but the homesteaders of the la have cut up the great ranches into sn and created a demand for water with make their crops grow. Cotton fields ing their way now into western Texas. fields are confined for the most part to country, but the belt of irrigated la general farm products flourish extend Paso to the Guadalupe, and from the R to the Red River on the north.

Irrigation is, however, no new thing It must not be forgotten that the State is a commonwealth with the ror tory that befits a border State. Long became a republic the Indians were land along the Rio Grande. Afte Franciscan friars who came with the e ish conquerors carried on irrigation fo tivation of their fields in the southwe of what is now the State of Texas. In northern and central parts of the St tion has been carried on to a limited many years.

For some time irrigation developm Pecos and Rio Grande valleys has bee by the lack of water supply which the mand on those rivers in New Mexico rado occasions. There are many pl ever, in the trans-Pecos country, wher ing dams might be constructed acro canyons or gorges to form reservoi storage of flood waters.

In the Pecos valley and along the Tom Green County water for irrigatic from flowing streams. Big springs gation systems along Toyah and creeks in the trans-Pecos country and San Felipe and San Antonio rivers. the best results in the State are prod rigation from artesian wells near Sa and in the Rio Grande country fr Christi to Brownsville. About 200 go wells have been sunk in this neighbor last few years.

Gravity systems, pumping plants, a wells are all utilized by farmers who valleys of the Colorado and San Ant the most important of the Gulf stre culturists realize more fully each ye vantages to be derived in years rainfall from a system of irrigation.

Many of the truck farms in sout are supplied from surface wells, th which is pumped into small reservoi 3,000 to 5,000 cu. ft. capacity. Ov wells are in use at present. It is est 75 per cent. of the irrigation in Te 1904 was accomplished by means plants, and 70 per cent. of the area pumps was cultivated in rice.

The use of impounding reservoi entered very largely into the irrig omy of the State, but as the deman

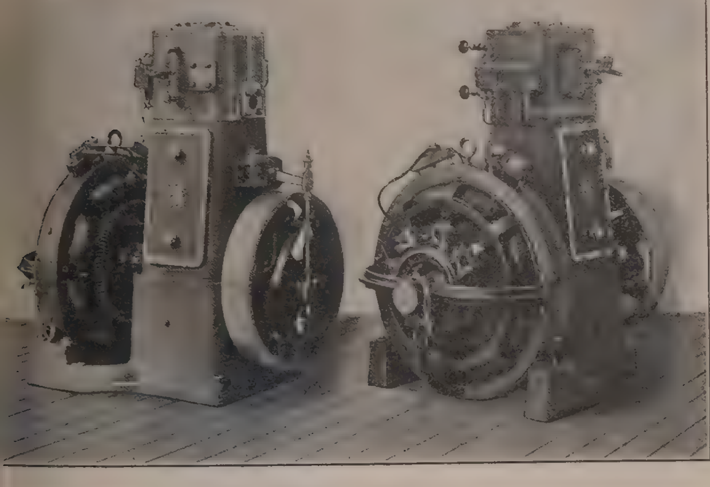
attention is turned to this source of sup-
d the storage reservoir at Wichita Falls
ɔn be duplicated at scores of other points
as. San Saba Valley, above the town of
ba, is one of the most fertile sections in
rld, and definite plans have been made
construction of a dam across the canyon
18 miles above the town to form an im-
storage reservoir from which water can
lucted to the valley below. This canyon
t 50 miles in length, and by means of a
of dams and canals it is believed that
40,000 acres above and below the town
Saba can be brought under ditch. Irri-
along this stream from the head of the
to the springs already take practically
tire normal flow of the stream, making
stem in the lower San Saba dependent
on storage water.

Llano River in Kimble County supports
ent many small irrigation plants, but large
could be constructed in the vicinity of
n City to utilize the flow of the South

headwaters of the Nueces and Frio are
ial in character and impounding reser-
an be constructed in the canyons north-
f Uvalde, from which the water could be
to the valleys above and below the South-
cific R. R. Devils River also offers op-
ties for impounding waters, and carries
tantial and reliable discharge. It would
ands in the vicinity of Del Rio.

W STURTEVANT GENERATING SET.

generating set shown in the accompanying
tions has been developed from designs
lly made by the B. F. Sturtevant Co. of
. Mass., for the use of the United States
and in accordance with specifications of
reau of Equipment. The engine is of the
eed reciprocating type, designed to run
r.p.m. The cylinder, which is cast with
ame, is 4½-in. diameter and has a
stroke. The valve is of the balanced piston
ınd is operated by a Shepherd governor



NEW STURTEVANT GENERATING SET.

d to the flywheel. Quick action and reg-
within 1½ per cent. from full load to no
secured with this governor, the makers
The piston is secured to the rod by a
fit, while the rod itself is held to the
ead by a setnut. The cross-head, which
e slipper type with forked end connecting
s a pin of 1¼-in. diameter and 1¾-in.
while the crank pin is 2-in. in diameter
½-in. long. and the main bearing is
in. in diameter by 6-in. long.

generator is of the eight-pole type, de-
for a continuous output of 5-kw. at 650
The cast magnet frame has attached to it
ugh bolts pole pieces of wrought iron
st iron shoes. Each pole piece is ener-
y its own field coils which are easily re-
. The armature is of the iron-clad, two-
ventilated drum type. The brushes are
l upon studs which project from a brush
attached directly to the magnet frame,
g being so arranged that it may be ro-
r adjusting the position of the brushes.
ush holders are of the sliding socket
ype. Each brush and holder may be sep-
adjusted, and is readily removable for
g and repairs.

generator is rated as capable of carrying
rt periods of time 50 per cent. overload,
shifting of brushes or flashing at com-
r. and is capable of continuous operation
er cent. overload without sparking or undue heating. After a continuous run of ten hours at full load the increase in temperature above that of the surrounding atmosphere will not exceed 40° C., in any of its parts, the makers state. The insulation resistance is designed to withstand a breakdown test of 1500 volts for one minute and show a resistance of at least one megohm with an initial voltage of 500.

The total weight of the set, which includes the engine, generator and sub-base, ready for operation, is 1140 lb.

THE STEAM BOILER EXPLOSION AT BROCKTON. MASS.

By the Hartford Steam Boiler Inspection & Insurance Co.

On Monday, March 20, at about 8 o'clock, a boiler exploded in the shoe factory of R. B. Grover & Co., at Campello, in Brockton, Mass., demolishing the factory, setting fire to the ruins and to the buildings in the vicinity, and causing an enormous loss of life. Up to the time of writing, fifty-five bodies are known to have been recovered from the ruins, and some fifty other persons are still missing, though it cannot be said that they were killed. The bodies that have been recovered were so badly disfigured or destroyed by the fire that followed the explosion, that only about seventeen of them have as yet been positively identified. The property loss due to the explosion alone is estimated to have been about $80,000; and Chief Harry L. Marston, of the Brockton fire department, is quoted as estimating the subsequent loss due to fire at no less than $250,000, counting the damage both to the Grover plant and to neighboring buildings. It is difficult, of course, to form accurate estimates of the property loss in a catastrophe of this magnitude, and it is likely that the figures here given may be largely modified by further investigation. The data here given, however, are nearly enough correct to afford a good general idea of the terrible nature of the explosion.

The boiler which exploded was built in 1891, by Edward Kendall & Sons, of Cambridgeport, Mass., and it had been insured by the Hartford Steam Boiler Inspection & Insurance Co. since November, 1892. It was of the ordinary horizontal tubular type, 72 in. in diameter, and 17 ft. long. The steel plates of which the shell was composed were ⅜ in. thick, and the sheet that failed bears the stamp of Carnegie, Phipps & Co., who certified that it is "fire-box steel" with a tensile strength of 60,000 lb. per square inch. So far as known, the material used in the construction of the boiler was excellent throughout, and the boiler was believed to be in good condition and thoroughly safe. The owners were permitted, by the insurance contract, to carry a steam pressure of 90 lb. to the square inch; but the usual working pressure was only 80 lb. The last complete internal inspection made by the Hartford Company was made on Dec. 28, 1904, and at that time an exceedingly careful examination by this company's experts failed to give the least suggestion that the boiler was not safe in every respect, and the company had no hesitation whatever about continuing its $10,000 policy upon it.

Two of the Hartford Company's experts are now engaged in a study of the explosion and its causes, and when detailed reports have been received from them, the whole story will be presented in the company's periodical, The Locomotive. So far as can be judged from the data at present available, the boiler gave way initially at the horizontal riveted joint on the rear course of plates. The opinion is substantiated by the views independently expressed by Thomas Hawley, who was formerly state inspector of boilers in Massachusetts, and who has had a large experience in matters of this kind.

The nature of this initial fracture will be understood by reference to the accompanying illustrations. Fig. 1 is a side view of the exploded boiler, and the position of the initial fracture is indicated by the dotted line, to which the arrow points. In Fig. 2 an enlarged view of a portion of the joint is given, showing the crack in detail. It will be seen that it started from the inner surface of the outer sheet, and progressed outward, until the strength of the outer sheet was destroyed. It will also be evident that a crack of this character may easily exist in a boiler, and yet give no evidence of its presence, until the outer plate is destroyed. It cannot be seen, either from the inside of the boiler, or from the outside. The Hartford Steam Boiler Inspection & Insurance Co., recognizing the occurrence and the danger of this particular kind of defect, made every effort, immediately after the X-rays were discovered, to design and construct an apparatus which should enable the inspector to detect a hidden crack of this sort, realizing that it could be discovered with absolute certainty in no other way. Unfortunately, it has not yet been found possible to construct apparatus of this sort which would be portable, and yet be powerful enough to produce rays capable of penetrating boiler plate. The only certain way of detecting cracks of this nature is by taking the boiler apart, and this procedure, in the absence of any other indication of the defect, is, of course, not practicable.

The Hartford Co., in its publication, The Locomotive, has repeatedly called attention to this particular type of defect, and to the difficulty of detecting it. It has also trained its inspectors to look for it with the greatest care, and to order a boiler shut down when the slightest indication of such a crack can be detected. The thoroughness with which this work is done can be estimated from the fact that in the year 1903 (the last for which complete returns are at present available) the inspectors of the company found no less than 4,030 cases of cracked plates in the boilers that they examined, although these were not all of the type here illustrated.

These hidden cracks are found only (so far as we are aware) in connection with lap-riveted joints, where one of the plates of the boiler overlaps the other, as shown in Fig. 2. The Hartford Co. has constantly recommended the use of butt joints, where the two plates to be joined are butted together, and secured by means of covering straps. It is difficult to persuade designers to adopt this form of joint universally, however, as many competent engineers are still of the opinion that the lap joint is equally good except for the highest pressures. Probably 90 per cent. of all the joints now in use on boilers are of the lap style, and the remaining 10 per cent. or so have been put in largely through the insistent urging of the Hartford Steam Boiler Inspection & Insurance Co. Designers are slow to adopt the butt joint, however, and even now, after the Hartford Co. has been advocating this joint for many years, we find that the standard Hartford designs, calling for butt joints, are almost daily modified by other mechanical engineers, and by boilermakers, so as to substitute the lap joints for the butt joints that are specified; and this, too, for pressures far in excess of the pressure that was allowed on this boiler.

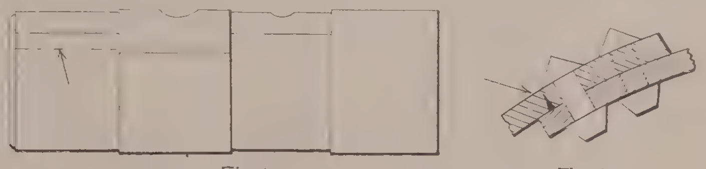


Fig. 1 Fig. 2

DIAGRAMS OF PROBABLE CAUSE OF BROCKTON BOILER EXPLOSION.

AIR COMPRESSORS FOR HUDSON RIVER TUNNELS.

The contract for the compressed-air power plant to be used in driving the second pair of trolley tunnels under the Hudson River, at New York, has been awarded to the Ingersoll-Sergeant Drill Co. These tunnels, which are popularly known as the Cortlandt St. tunnels, for the reason that their New York terminal will be located on that street, are to be built by the Hudson Companies, of which Mr. Chas. M. Jacobs is the chief engineer. The shield method of subaqueous tunneling will be used.

The order includes five duplex air compressors. Three are low pressure class H machines, with steam cylinders 14 and 28 in. in diameter and air cylinders of 22¼-in. diameter and 16-in. stroke. They give a maximum air pressure of 50 lb. per square inch and have a capacity of 1,850 cu. ft. of free air per minute each. The other two are class HC machines for high pressure, with steam cylinders 14 and 28 in. in diameter, air cylinders 24¼ and 14¼ in. in diameter and a 16-in. stroke, with a maximum pressure of 125 lb. per square inch and a combined capacity of 2,000 cu. ft. of free air per minute.

This makes 38 Ingersoll-Sergeant air compressors, with a total capacity of 117,234 cu. ft. of free air per minute, now installed or ordered for the various tunnels under the Hudson and East Rivers.

A REMARKABLE TUNNEL INCIDENT.

An unprecedented occurrence resulted on March 27 from a blow-out at the Brooklyn end of one of the twin tunnel tubes now being driven across the East River to Battery Park for the Rapid Transit R. R. What might easily have been a fatality, and indeed escaped being one by a margin of only a few minutes, actually resulted in nothing more serious than a little delay of the work and some slight expense for pumping, no damage having been done to the structure or construction plant and no lives lost or men injured. The air pressure in the heading burst through the mud roof just in advance of the shield, tore up a portion of the river bottom, and escaped with such force as to throw a column of water several feet above the surface of the river. The peculiar feature was that a man was caught in the rush and carried from the tunnel to the upper air and rescued from the river uninjured. That part of the tunnel which had been excavated in advance of the shield was eventually flooded, but not before the rest of the workmen there had escaped through the bulkhead doors, provided for such emergencies, and closing them after them, protected the finished tunnel. The facts are concisely stated in the following official report by Mr. Geo. S. Rice, acting chief engineer of the Rapid Transit R. R. Commission:

"I beg leave to report that a blow-out occurred at the north shield of the Joralemon St. tunnel this morning (March 27) at about 8.20 o'clock, and the tube back to the lock has been flooded. A laborer was blown out by the escaping air and came to the surface of the water, being rescued by two men who were collecting drift wood. Four other men working in the tube were injured, but not seriously. One of them was thrown against the outer braces of the shield and was caught in the mud, and his companions succeeded in temporarily stopping the break and rescued him at 8.50 A. M. Five minutes later a second blow-out occurred, which flooded the tunnel to the top of the shield. Assistant Engineer Sanborn was in the tunnel at the time. The shield was located near the bulkhead at the foot of Joralemon St., and had advanced to a point about 20 ft. beyond the spring piece of the bulkhead. The top of the shield is nearly 28 ft. below mean high water. A boulder in the top pocket in the excavation, which had to be blasted, probably was the immediate cause of the blow-out. There was a pressure of about 14 lb. in the tube under normal conditions, which pressure dropped to about 10½ lb. when the accident ocurred."

The tunnel and the methods of construction have been illustrated in The Engineering Record of March 5 and 12, 1904, and the operations there described are substantially the same as are now in progress. The tunnel will consist of two parallel, single-track, cast-iron tubes about 28 ft. apart on centers, lined with concrete and having a clear inside diameter of 15½ ft. They are being driven under compressed air by the shield method and are equipped with improved hydraulic and pneumatic apparatus and special safety appliances to prevent injurious effects to the men from the compressed air. The headings from the New York side have advanced nearly to the middle of the river and are making good progress under an air pressure of about 27 lb. per sq. in.

On the Brooklyn side the roof is soft and thin, and in order to reinforce it the contractor has applied for a permit to cover it with a fill of earth or clay to increase the weight opposed to the upward air pressure. This permit has not yet been granted and the air blew through a weak place, as it had previously done without causing any particular damage. The cavity thus made in advance of the shield will be covered by a tarpaulin, clay will be dumped over it, and the excavation will be resumed in the regular way.

ROOFING IN HOT CLIMATES

Until a few years ago the roofs of houses in hot climates where Latin races dwell were generally made of ordinary tile in the best structures and clay or mere mud in the others. Little by little the conservatism which retained such construction in the face of its manifest disadvantages has been relaxing in favor of high-grade composition roofing. The change has been slow, not only on account of the necessity of overcoming local prejudice against a new material, but also because of the alterations in customary structural details which had to accompany it.

It is interesting to learn, however, that long-time tests in Latin countries of durable and odorless composition roofing like the "Ruberoid" brand made by the Frank S. De Ronde Co., of New York, has at last resulted in a general appreciation of the merits of such material in hot climates. When made for such service, it must contain only such materials as will not run when heated by the sun. If this precaution is observed, the heat-insulating properties of composition roofing combine with its light weight and resistance to the action of steam and gases make it peculiarly serviceable for many building purposes in warm climates. The adoption of the material by American engineers connected with industrial works and railways in Latin America occurred years ago, but it is only comparatively recently that the success of these roofs built by foreigners has led the citizens of the southern countries to follow the practice.

BUSINESS NOTES.

The engine-building firm of The Ball & Wood Co., Elizabeth, N. J., has decided to manufacture a welded pipe joint. The company proposes to make a type of joint suitable for the high steam pressures prevailing and the use of superheated steam, and to that end is erecting a smith shop for welding flanges and bending pipes.

The Hardie-Tynes Mfg. Co., Birmingham, Ala., states that the recent fire did not affect any part of its plant other than the foundry department, and this it will be able to get in condition in about thirty days. Fortunately it had a large stock of finished and unfinished castings for standard work, so that the machine shop and other departments can be kept at full capacity and deliveries will not be affected.

The Abner Doble Co., of San Francisco, reports, among orders recently taken, the following: For the Electra plant of the Standard Electric System, three 7500-h.p. waterwheels to operate under a 1250-ft. head at 400 r.p.m., and the other two direct-connected to one 4000-k.w. generator, forming a double unit for utilizing water from two separate sources under different heads. One of the wheels will be driven by a 6-in. jet under a head of 1465 ft., and the other wheel is to be driven by a 7-in. jet under a head of 1250 ft. These operating conditions are only made possible by the use of Doble needle nozzles, which regulate the quantity of water delivered to each wheel. A 200-h.p. exciter wheel to operate under a head of 1465 ft. at 720 r.p.m. will also be furnished for the Electra plant. Two 800-h.p. main unit wheels and two 40-h.p. Doble exciter wheels have been built for the new Santa Ana No. 2 plant of the Edison Electric Co., of Los Angeles. These operate under a head of 305 ft. Two 75-h.p. exciter wheels have been built for the Pike's Peak Hydro-Electric Co., of Colorado, to operate at a speed of 975 r.p.m. under a head of 2100 ft., the highest in the United States. A 300-h.p. double wheel, equipped with two Doble needle regulating nozzles, has been ordered by the Hilo Electric Light Co. of Hawaii. For the Nevada City plant of the California Gas & Elec. Corporation, three 570-h.p. wheels have been supplied to operate under a head of 190 ft. The California Fish Commission has ordered a wheel to work under the low head of 23 ft. The Braden Copper Co., of Chile, has ordered four 340-h.p. wheels for operation under 930-ft. head, three for belt drive and one for direct connection to an electric generator. An interesting order recently received calls for a complete sawmill outfit to be installed in the Philippine Islands, the machinery to consist of a wheel operating under 400-ft. head and directly connected to the mill.

The Shenango Furnace Co., of Pittsburg, has recently made an increase in its blowing capacity at the Sharpsville (Pa.) works, by the installation of another vertical Reynolds-Corliss engine, with steam and air cylinders of 44 and 84 in. diameter, respectively, and a 60-inch stroke. This is one of the ordinary long cross-head blowing engines which the Allis-Chalmers Co. has been furnishing for some time past from its Scranton works.

A very large contract for sewer pipe was recently awarded to the Gordon Engineering Co., Cincinnatus Bldg., Cincinnati, by P. J. McNerney, of the same city. It was for approximately 1,200 car loads, mainly for a sewerage system for New Albany, Ind., and will be made by the Stratton Fire Clay Co., Empire, Ind.

The Hecker-Jones-Jewell Milling Co., New York, has ordered three vertical cross-compound Reynolds-Corliss engines from the Allis-Chalmers Co. Two will be arranged for rope drives and the third for direct connection to a Bullock generator. The three engines are rated at 3,250 h.p. altogether.

The Levering & Garrigues Co., 552 West 23d St., New York, has just finished the steelwork on the 600-ton Park Bank Bldg., New York, which is seven stories high and has two domes 60 ft. in diameter, with a large amount of ornamental ironwork; the ornamental ironwork of a 1,200-ton publishing house for Street & Smith and an eight-story extension to the St. Vincent hospital; the fifth tier of steel is being erected on a six-story principal building of the group for the new Rockefeller Institute, and the second tier is being erected for a large four-story building for the Sevilla Home at Hunt's Point, Borough of the Bronx. The last tier of beams is being erected for a local Carnegie library, and erection is about to commence on a 900-ton, 80x100-ft., twelve-story apartment house at 84th St. and Riverside Drive. The steelwork for a large stable is now in the shops, and drawings are being made for a number of buildings.

The American Car & Foundry Co. has ordered from the Allis-Chalmers Co., for its Chicago plant, a horizontal, cross-compound Reynolds-Corliss engine, with cylinders 14 and 32 in. in diameter and a 36-in. stroke, and a 350-k.w. Bullock generator.

The American Bridge Co. is operating all of its plants which are considered to be in service, some of them to their full capacity, and considers the present condition of railroad work satisfactory, with prospects of continued or increased activity. Many important orders are booked, and many more are promised, but an unusual peculiarity is noticed in that an exceptionally large amount of this work which has been contracted for is delayed by lack of information needed for completing the designs. In many instances the work has been authorized and general designs approved, but the final data from the division engineers, who are to receive the structures, are not forthcoming, and the amount of such work that is delayed is so large that if it should all be released at once it might, in combination with difficulties of securing prompt shipments from the mills, seriously derange future contracts. There is satisfactory activity with highway bridge work throughout the country, and about the usual amount of ordinary work of this class is being built, although there is a marked dullness in electric railway bridgework. It is noticeable that concrete is superseding steel bridgework in the Middle West, where there is often a scarcity of suitable building stone for substructures. Structural steelwork is very dull; in New York City, where there is ordinarily a consumption of from 30 to 35 per cent. of all this class of work in the country, there is no new construction of importance, and in the rest of the country the new work is not more than 50 to 75 per cent. of the average. The Ambridge shops are working to their full present capacity of about 10,000 tons per month and are now running on the new industry of building steel barges, one of which is launched there every few days. The total bridge and structural product is at present about normal, but although the capacities of the rolling mills have been considerably increased of late, their shipments are now behindhand and new orders cannot be filled in much less than six weeks. It is estimated that the steel car manufacturers running at their full capacity would require nearly the total output of steel plates, and as their orders for the past three months are double the usual yearly average it may have some bearing on the condition.

The Robert Gair Co. will shortly begin the installation at its factory in Brooklyn, described in this journal on March 4, of three new power units, with an aggregate capacity of 500 k.w. These units will be heavy-duty, horizontal, non-condensing Reynolds-Corliss engines, two with cylinders 22 in. in diameter and one with a cylinder of 16 in., each having a 36-in. stroke, direct-connected to Bullock generators.

PERSONAL NOTES.

Mr. Ralph E. Shaner has been elected borough engineer at Pottstown, Pa.

Mr. Alexis H. French has been appointed city engineer of Brookline, Mass.

Mr. Frederick C. Schneider has been elected city engineer of New Brunswick, N. J.

Mr. W. P. Darwin has received the appointment of assistant engineer in the engineer department of the District of Columbia.

Col. Frederick Defuniak, formerly chief engineer of the Louisville & Nashville Ry., died at his home in Louisville, Ky., March 29.

The offices of city engineer and water superintendent of Barre, Vt., have been consolidated, and Mr. Chas. R. Allen, Jr., has been appointed to the new office.

Mr. E. G. Helm will deliver a lecture on "The Levee and Drainage Problem of the American Bottoms" at the meeting of the Engineers' Club of St. Louis on April 5.

Mr. Harry P. Nichols has been promoted from the position of assistant engineer to that of principal assistant engineer in the Department of Finance, New York City.

Mr. H. W. Scott, principal assistant city engineer of Seattle, Wash., has been authorized to take charge of City Engineer R. H. Thomson's duties while the latter is absent on a trip to Europe.

Mr. F. W. Scarbrough, chief engineer of maintenance of way of the Chesapeake & Ohio Railway, has resigned and Mr. F. J. Cabell, chief engineer of construction, is to occupy the position vacated by Mr. Scarborough. Mr. H. Pierce, division superintendent, is to take Mr. Cabell's present position.

Mr. H. U. Wallace, chief engineer of the Illinois Central R. R., has resigned to take up business work, and has been succeeded by Mr. A. S. Baldwin, who will also retain charge of the maintenance of way and construction department. Mr. H. R. Stafford has been appointed first assistant engineer.

Mr. Wm. H. Jennings, of the firm of Jennings & Talbot, died at his home in Columbus, O., March 16. Mr. Jennings was formerly chief engineer of the Hocking Valley Ry., and since leaving that road, about 15 years ago, has devoted his time to construction as well as engineering work, having more recently been engaged in railroad contracting.

Supervising Engineer B. M. Hall, who has had general charge of the investigations in the Rio Grande valley in New Mexico and Texas, has been appointed supervising engineer for the territory of Oklahoma, and will direct the operations of a number of field parties engaged upon surveys in that territory. He will continue in charge of work on the Rio Grande.

Mr. H. W. Marean has been transferred to the U. S. Reclamation Service from the Bureau of Soils, Department of Agriculture, and appointed assistant engineer of soils. He will report for duty at Minidoka, Ida., under the direction of Engineer of Soils Thomas H. Means, and will make a careful investigation of the irrigable lands under the Government project at that place.

Mr. John L. Mann has been appointed assistant engineer in the U. S. Reclamation Service and ordered to report to Mr. Raymond F. Walter, engineer in charge of the Belle Fourche project, at Belle Fourche, S. D. Mr. Mann is a graduate of Dartmouth College and the Thayer School of Civil Engineering. He has had a great deal of practical experience in his line of work and taught at the Thayer School for four years.

Mr. Rufus Hill, master mechanic of the Pennsylvania R. R. shops at Camden, N. J., has retired, having reached the age limit for the company's staff. He entered the service of the old Camden & Atlantic R. R. in 1857 and continued there until 1871, when he was placed in charge of the shops at Cooper's Point. In 1883, when the road was leased to the West Jersey R. R., the shops were removed to Pavonia, but Mr. Hill continued to be at their head.

Mr. W. W. Schlecht, assistant engineer in the U. S. Reclamation Service, has been assigned to Oklahoma, and under the direction of Supervising Engineer B. M. Hall will make reconnaissance surveys of possible irrigation projects in Woodward and Beaver counties, during the coming season. Mr. Schlecht graduated from
Columbia University with the degree of
and has since been engaged with the Nica
Canal Commission and the Geological S

A number of changes have been anno
in the engineering departmet of the Great N
ern Ry. Mr. R. E. Taft has been appointe
gineer of construction with headquarters
Paul, Minn. Mr. F. B. Walker, who has
in charge of the tunnel work in Seattle,
has been appointed resident engineer at Su
Wis., the position vacated by Mr. Taft.
G. A. Casseday has been promoted to the
tion of bridge engineer, with headquarte
St. Paul, and Mr. Samuel L. Bartlett, as
tect, with headquarters also in St. Paul.

Mr. Archibald M. Gilbert, of New Yor
received an appointment in the U. S. Re
tion Service as engineering aid, and o
to report to Mr. John T. Burke, Minidoka

Mr. Harry J. Morrison has resigned
vision engineer of the Metropolitan Wate
Sewerage Board and has associated himsel
Mr. W. S. Farrington, under the firm na
Morrison & Farrington, consulting eng
513-4 Dillaye Memorial Building, Syr
N. Y. Mr. Morrison has been connecte
the construction of the Metropolitan
Works since 1895, and recently had cha
the work in the reservoir department. Mr
rington has been in business at Syracu
about 10 years.

Mr. Henry R. Evans, assistant engineer
U. S. Reclamation Service, who has be
gaged on the Huntley project, Mont., ha
assigned to duty in connection with the
ing projects in North Dakota. He will
a large part of his time to the investigat
coal veins, making borings and test pit
studying locations for pumping plants.
Evans has had wide experience in his
having been engaged at various times a
veyor General of Colorado, engineer for a
company in Dutch Guinea, and instruc
mining engineering in the Nevada State
versity. The following men have also
been assigned to duty in South Dakota
George O. Sanford, assistant engineer, F
Davis, engineering aid, and John W. Kit
assistant engineer.

Mr. W. A. Stadelman, general eastern
of the Brown Hoisting Machinery Co., ha
appointed general eastern agent of the W
Seaver-Morgan Co., of Cleveland, O., w
fices at 42 Broadway, New York City.
Stadelman has been prominently identifie
the electrical and machinery industries fo
than 20 years. From 1883 to 1891 he was
at Philadelphia, Pa., for the Sprague
Railway & Motor Co., and chief engineer
Equitable Electric Railway Constructio
having direct charge of the sale of S
electric railway apparatus and the const
of electric railways for that company in P
vania, New Jersey, Delaware and Ma
During this time he built over thirty
railways and was also general manager
Bristol, Tenn., Belt Line Ry. He becam
ciated with the Niles Tool Co., of Ha
O., in 1891, as special traveling represe
and during 1895 was in charge of the Pi
office of that company. From 1895 to th
ent he has been general eastern agent
Brown Hoisting Machinery Co.

Mr. Alexander C. Shand, engineer of
tenance of way of the Pennsylvania R.
been appointed assistant chief engineer
ceed Mr. Louis H. Barker, who has r
because of ill-health. Mr. Barker was ap
last December to fill the position made va
the death of Mr. W. A. Pratt, but the c
of his health has permitted him to do litt
since then, and after spending several w
Florida, without any improvement, he
signed. Mr. Shand entered the service
Pennsylvania R. R. in 1879, and rose
various positions to that of principal a
engineer at Altoona in 1900, and superin
of the Altoona division in 1901 and h
position until appointed to his present
A number of other changes in enginee
partment of the Pennsylvania R. R.
announced. Mr. L. R. Zollinger, princ
sistant engineer at Altoona, has been p
to the position of engineer of mainten
way to succeed Mr. Shand. Mr. A. J
ney, Jr., assistant engineer of the West
& Seashore Ry., will take Mr. Zolling
ent position at Altoona. Mr. J. H. Gu
sistant engineer of the Monongahela divi
been advanced to the position vacated
Whitney, and Mr. A. B. Cuthbert, assis
gineer of the Elmira & Canandaigua div
the Northern Central Ry., will occu
Gumbs' present office, Mr. Walter Thom
ceeding Mr. Cuthbert.

NTRACTING NEWS

OF SPECIAL INTEREST TO
TRACTORS, BUILDERS, ENGINEERS
AND MANUFACTURERS
GINEERING AND BUILDING SUPPLIES.

WATER.

tes Arranged Alphabetically by States.

acauga, Ala.—Contracts for constructing works were awarded on Mar. 10 as fol- Arthur Pew, Engr., Atlanta, Ga.) to the n Pump & Fdy. Co., Chattanooga, Tenn., 0,000 gal. pumps, one simple, one comp., J. S. Schofield's Sons Co., Macon, Ga., -in.x16-ft. boilers, $1,988; Means & Fulton Vks., Birmingham, Ala., 80,000 gal. tank er 74 ft. high, $3,242; Ball Engine Co., Pa., engine 12x14-in. cylinders, 128 indi- .p., $1,190, and to Bullock Elec. Mfg. Co., nati, O., one 75-kw. 2 phase generator,

on, Ariz.—Frank S. Treat, City Clk., that the election which was to have been n Mar. 20, to vote on issuing $250,000 for improving water supply, sewers, etc., en indefinitely postponed.

dena, Cal.—T. D. Allin, City Engr., writes e citizens voted to purchase the water of the West Side Co., East Side Co., Pasadena Co., and the plant at San Gabriel s, and to expend $198,750 on improve- and extensions.

tier, Cal.—E. C. Butterfield, City Clk., that it was voted Mar. 14 to issue $10,000 for water-works improvements.

ras, Cal.—The question of installing a of water works is reported under con- on here. Whether a private company will the plant or the town, has not yet been .

n Park, Cal.—It is reported that about will be expended by the new owners of k Water Co. in improvements.

ker, Colo.—W. H. Clark, Town Engr., that P. P. Ford, Cooper Bldg., Denver, ured the contract for constructing water bids opened Mar. 20) at $45,000, if wood used throughout, or $51,000, if wood used on main line and cast iron in town.

len, Conn.—Local press reports state Water Dept. expects to lay about 6,870 -in. water mains this season.

ington, D. C.—The Secy. of the Interior rted to have set apart $1,300,000 from amation fund for the purpose of begin- erations in connection with the Payette- rigation project in Idaho, and $1,000,000 same purpose in connection with the ver project in Montana. It is calculated ,000 acres will be reclaimed in Idaho, ,000 in Montana, and the ultimate cost two enterprises is fixed at $11,000,000 ,000,000, respectively.

ndina, Fla.—It is stated that bids will be until Apr. 15 by C. V. Hillyer, City furnishing material and sinking an ar- ell.

dria, Ind.—It is reported that the Bd. Wks. will soon let contract for a 50,000- dpipe for the factory district.

bus, Ind.—The City Council is reported decided to commence at once the con- of a filtration plant, to cost from to $40,000.

rset, Ia.—See "Power Plants, Gas and ty."

oldt, Kan.—Bids will be received Apr. uy Speakman, City Clk., for construct- equipping pumping plant, also for a ower, in connection with the Water Burns & McDonnell, 509 Dwight Bldg., City, Mo., Engrs.

ta, Me.—Bids will be received by W. B. Engr. Augusta Water Dist., on Apr. aying a c. i. pipe line, about 8½ miles h, with appurtenances, from Carleton inthrop, to the distributing reservoir of usta Water Dist., in Augusta, as adver- The Engineering Record.

age dam, about ½ mile in length, will ructed by the Augusta Water Dist. this W. B. Getchell, Engr.

er, Me.—It is reported that a new pump bably be constructed by the Gardiner Dist. Fred Danforth and Freeman Pat- stees.

, Me.—Mayor Wm. B. Peirce in his essage recommends that an appropriation and authority given to make a thor- estigation of the water supply.

efield, Mass.—Chas. Miller & Son, of e stated to have secured the contract ishing about 200 tons of 6 and 8-in. at $26.95 per ton and special castings per lb.

Andover, Mass.—Jas. W. Leitch, Town tes that it is proposed to install new water works, at a cost of $6,000. Goldsmith, Supt. Water Wks.

, Mass.—The Council is reported to sed to a second reading an order ap- g $25,000 for water extensions.

, Mass.—At the town meeting Mar. 20 ns are reported to have voted to ap- $55,000 for the construction of water

Mendon, Mich.—See "Power Plants, Gas and Electricity."

Freeport, Minn.—It is reported that water works will be constructed here at a cost of $15,000.

Walker, Minn.—See "Power Plants, Gas and Electricity."

Barnesville, Minn.—The question of issuing $40,000 bonds for the construction of water works is reported under consideration here.

Trenton, Mo.—The Chicago, Rock Island & Pacific R. R. Co., (W. L. Darling, Ch. Engr., Chicago, Ill.) is reported to have decided to construct water works here at a cost of $20,000.

Merna, Neb.—The citizens are reported to have voted to issue $4,000 bonds for water works.

Princeton, N. J.—The State Senate is reported to have passed a bill authorizing this city to buy or construct water works.

Newark, N. J.—The City Controller is reported to have sold bonds on Mar. 24 as follows: $1,950,000 Cedar Grove reservoir bonds, and $370,000 school bonds.

Brooklyn, N. Y.—Bids will be received by John T. Oakley, Comr. Water Supply, Gas and Electricity, N. Y. City, Apr. 12, for furnishing and delivering corporation cocks; also hydrants, as follows: Section 1, specification (a), 400 double nozzle hydrants; section 2, specification (a), 400 double nozzle hydrants; section 2 and specification (b), 200 extra long double nozzle hydrants.

Albany, N. Y.—Comr. of Pub. Wks. Bissell is stated to have submitted to Council a report on the proposed water works improvements. He estimates the cost as follows: $170,000 for 4 new filters; $40,000 for a new intake; handling sand, electric light, etc., $10,000; new engine at the Quackenbush Station, $80,000; improvements to the several reservoirs, $70,000; engineering inspections and other incidentals, $30,000. The estimate includes the cost of new water pipes; he suggests that the old pumping engine at the Quackenbush station be sold or exchanged for a new engine; also that plans and specifications be drawn up and submitted to the Bd. of Contract and Supply for approval.

Medina, N. Y.—Press reports state that an injunction restraining the village of Medina from letting contracts for construction of the proposed $100,000 water works for the village, was sustained by Justice Lambert at Buffalo on Mar. 21. The bids for this work were opened on Mar. 1, and the figures received were reported in the issue of The Engineering Record, Mar. 25.

Graham, N. C.—See "Power Plants, Gas and Electricity."

Mandan, N. D.—It is reported that estimates are to be prepared for water works.

Cincinnati, O.—The only bid received by the Bd. of Water Wks. Com. on Mar. 14 for the 12,278 tons of pipe to be used in connection with the new works is stated to have been submitted by the U. S. Cast Iron Pipe & Fdry Co., for $413,568.

Portsmouth, O.—It is stated that bids will be received until Apr. 7 by the Bd. Pub. Service (Chas. C. Bauer, Clk.) for furnishing not more than 8,000 ft. nor less than 5,000 ft. 6-in. c. i. pipe and necessary fittings; also 24 three-way

Geneva, O.—It is stated that bids will be received until Apr. 4 by the Clk. Bd. Trus. of Pub. Affairs for constructing water-line extensions.

Akron, O.—Press reports state that the State Bd. of Pub. Wks. (Chas. E. Perkins, Ch. Engr. Columbus) will construct a reservoir between Long Lake and State Mill.

Jackson, O.—Solon C. Smith writes that this city has had water works in operation for several years. He further states that the citizens on Feb. 20 voted to issue bonds for a sewerage system, but the matter was afterwards withdrawn, a defective notice having been given. It is uncertain when or whether another vote will be taken for sewerage.

Portland, Ore.—It is stated that bids will be received until Apr. 12 by the Water Bd. for furnishing 2,012 tons 4 to 16-in. c. i. pipe and 120,000 lbs. special castings. D. D. Clark, Engr. Water Bd.

**Tillamook, Ore.*—Local press reports state that the following are the bids opened on Mar. 15 by the Water Comn. for constructing water works, to consist of a distribution system 3 miles in length and a main line 5.8 miles long (Engineer, Wm. B. Chase, 661 Worcester Bldg., Portland)—*a*, double riveted steel; *b*, Matheson; *c*, fir wood; *d*, wood sleeves: Wakefield & Jacobson, *a*, $41,767; *b*, $45,864; *c*, $43,044 (awarded contract); *d*, $41,981. Jacobson-Bade Co., *a*, $38,737; *b*, $48,150; *c*, $41,166; *d*, $39,420. C. A. Goddard, *a*, $42,007; *c*, $40,407.

Connellsville, Pa.—It is stated that bids will be received until Apr. 15 by the Riverside Water Co. for constructing water works, to cost about $30,000. T. J. Mitchell, Pres.

Ft. Pierre, S. D.—The city is reported to have sold $30,000 bonds to be used for the construction of water works. An artesian well will be sunk.

**Nashville, Tenn.*—The U. S. Cast Iron Pipe & Fdy. Co., of Chattanooga, is stated to have secured the contract for 6-in. water pipe at $25 per ton; total cost $12,000.

Bristol, Tenn.—See "Power Plants, Gas and Electricity."

Humble, Tex.—The City Council is stated to have decided to install water works.

Ogden, Utah.—It is stated that the Ogden Water Co. proposes in the near future to extend its water mains to the S. P. Ry. shops, at a cost of $10,000.

Salt Lake City, Utah.—It is stated that bids will be received until Apr. 10 by the Bd. Pub. Wks. (E. A. Wall, Chmn.) for laying water mains that may be ordered by the City Council, approximately as follows: 12,000 lin. ft. 6-in. and 800 lin. ft. 8-in. c. i. pipe and 5,000 cu. yd. excav. and back-filling.

Bristol, Vt.—Preliminary surveys and estimates are being prepared by Lloyd & Mann, of Concord, N. H., for a water supply system. Different sources will be investigated for both gravity and pumping systems.

Richmond, Va.—It is stated that bids will be received until Apr. 4 by C. C. Bolling, Supt. Water Wks., for gate valves, c. i. pipe, special castings, double-nozzle fire hydrants, meters, etc. standard fire plugs.

Colville, Wash.—C. H. Jackson, Town Clk., writes that it is proposed to construct water works at a cost of $12,000. No engineer selected as yet.

Ft. Flagler, Wash.—Capt. Geo. H. Penrose, Q.M., U. S. A., Port Townsend, writes that the following are the bids opened on Mar. 13 for furnishing and laying 6,675 ft. 6-in. c. i. pipe at Ft. Flagler: Hurley & Co., St. Paul, Minn., $9,500; Jacobsen-Bade Co., Port Townsend, Wash., $6,150; Jones & Crouten, Port Townsend, Wash, $7,650; McInnis & Harrington, Port Townsend, Wash., $9,745; Benj. W. James, Seattle, Wash., $9,075; McInnis & Cotton, Port Townsend, Wash., $6,378.

Prescott, Wash.—Chas. H. O'Neil, Town Clk., writes that bids will probably be received in June for water works, to cost about $7,000.

Superior, Wis.—Bids will be received Apr. 5 by the Bd. of Pub. Wks. (Claus Johnson, Chmn.) for sinking a drilled well at E. Itasca St. and Wise Ave.

West Allis, Wis.—H. D. Hill, Village Clk., writes that it was voted Mar. 25 to issue $60,000 water bonds and $15,000 bonds for sewers.

La Crosse, Wis.—Prof. Floyd Dans, who has been in the city making tests of the river, artesian and well waters, is stated to have completed his investigations, and a report of his findings has been submitted to Council. A mechanical plant is recommended. The cost will amount to about $100,000.

De Pere, Wis.—It is stated that bids will be received about May 1 for improvement to the water-works plant, consisting of c. i. pipe, 2 steel towers and tanks, 2 concrete reservoirs, 50-h.-p. gas producer and engine, 500-gal. triplex pump and power-houses. Address W. G. Kirchoffer, Engr., Madison, Wis.

Indian Head, N. W. Ter.—See "Power Plants, Gas and Electricity."

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

West End, Ala.—Press reports state that the date for receiving bids for $15,000 sanitary bonds has been extended from Mar. 21 to Apr. 11, and said bids will be received by P. S. Milner, Chmn. Finance Com.

Los Angeles, Cal.—City Eng. H. F. Stafford desires information concerning plants and pumping machinery for lifting sewage, preferably by compressed air.

San Jose, Cal.—Roy E. Walter, City Clk., writes that the citizens voted Mar. 18 in favor of constructing sewers in the College Park sanitary sewer district.

New Haven, Conn.—Local press reports state that the State St. sewer overflow, which will cost $40,000, will probably be constructed this summer.

**Augusta, Ga.*—Hollahan & Costello are stated to have secured the contract on Mar. 21 for constructing new sewers for $8,072.

East St. Louis, Ill.—Mayor Silas Cook is reported to have instructed City Counselor J. M. Freels to prepare the ordinance which provides for the construction of a $750,000 intercepting and outlet sewer to drain the entire city.

Moline, Ill.—Contracts for about 3½ miles of small pipe sewers will probably be let within the next 60 or 90 days. H. G. Paddock, City Engr.

East St. Louis, Ill.—See "Paving and Road-making."

Chicago, Ill.—Press reports state that the Bd. of Local Improv. on Mar. 22 ordered paving to the amount of $630,500, and new sewers at a cost of $220,500.

**Des Moines, Ia.*—Local press reports state that Wm. Horrabin has secured the contract for constructing the Ingersoll Run sewer (bids opened Mar. 11) for $33,459.

The lowest bid opened on Mar. 21 for constructing the Willow St. sewer was that of J. W. Turner, of Des Moines, at $5.47 per lin. ft. It will be a 24-in. sewer and in some places will require 30 ft. of excavation.

**Muscatine, Ia.*—Jas. J. Ryan, City Engr. writes that the following are the bids opened on Mar. 23 for constructing a section of main sewer from 8th to 11th sts: (*a*) concrete, (*b*) brick: Stolzenau & Mauer, Muscatine, *a* $8,916.50 (awarded contract); Davenport Constr. Co., Davenport, *a* $10,160, *b* $16,040; Peter G. Wingerter, Muscatine, *a* $10,847.35, *b* $14,195; Wm. Horrabin, Iowa City, *a* $11,058, *b* $21,860; A. Korneman & Co., Muscatine, *a* $11,140; E. Baker, Muscatine, *a* $13,060, *b* $14,422. The detail bid of Stolzenau & Mauer, the successful bidders, is as follows: 1,120 lin. ft, 10 ft. concrete sewer, $7.65 per lin. ft.; 50 cu. yds. concrete masonry, $3.75 per cu. yd.; 25 cu. yds. brick masonry, $5 per cu. yd., and 2 manholes, ea. $18.

Lexington, Ky.—Bids will be received May 1 by Thos. A. Combs, Mayor, for constructing an 8-in. sanitary sewer.

Baltimore, Md.—Mayor Timanus has signed the $1,000,000 park extension loan ordinance, and $10,000,000 park extension loan ordinance, and they will be submitted to the voters of the city at the election May 2.

Brookline, Mass.—Bids will be received Apr. 3 by the Bd. of Selectmen (Edw. A. McEttrick, Clk.) for furnishing cement, sewer pipe and sewer castings. Alexis H. French, Town Engr.

Corinth, Miss.—Kirkpatrick & Johnson, of Jackson, have been engaged to make surveys and plans for a new system of house sewers; about 7 miles of sewers comprised.

**Holly Springs; Miss.*—Contracts for constructing a system of house sewers with disposal works have been awarded to Guild & Co., Chattanooga, Tenn., for construction; to Montague & Co., Chattanooga, Tenn., for sewer pipe; to Herron Pump & Fdy. Co., Chattanooga, Tenn., for castings, and to Nashville Bridge Co., Nashville, Tenn., for steel trestle; total cost about $19,000. Kirkpatrick & Johnson, Jackson, Miss., are the designing and supervising engineers.

Long Branch, N. J.—The Long Branch Sewer Co. is reported to have decided to expend about $16,000 in improvements, to include the construction of a new outlet to the sea. Wm. R. Warwich, Chmn. Sewer Com.

Lakehurst, N. J.—The Lakehurst Sewer Co. is reported incorporated to operate a system of sewerage; capital, $12.000. Incorporators: Dorman T. Warren, Lakehurst; Frederic Crosby, New York City, N. Y.; Howard C. Warren, Princeton, and others.

Madison, N. J.—The Sewerage Com. is reported to have recommended that the sewage be carried to a point in the lower end of the town and there purified. A plan for the establishment of septic tanks and filter beds is endorsed. It further reports that an engineer be employed to prepare plans and specifications; also that the matter be brought before the voters.

Troy, N. Y.—Bids will be received until Apr. 7 by the Bd. Contract and Supply (Jas. M. Riley, Clk.) for constructing a public sewer.

Lestershire, N. Y.—J. E. Hill, City Clk., writes that it was voted Mar. 21 to construct a sewerage system.

New York, N. Y.—The following are the bids opened on Mar. 21 by Louis F. Haffen, Pres. Bronx Boro., for the construction of sewers—*a*, Jennings, 172d and Hoe Sts.; *b*, Clay Ave.; *c*, Locust St., N. and S. Oak Drives and Hickory Ave.: T. Del. Balso, 1480 Hoe Ave., *a*, $12,100. Thos. Grogan, 1864 Jerome Ave., *a*, $15,847; *b*, $9,184; *c*, $5,687. Geo. I. Bailey, 168th St. and Fulton Ave., *a*, $16,476; *b*, $10,611. Vermilye-Garry Co., 463 W. 144th St., *a*, 16,551. Pat. Goodman, *a*, $16,976; *c*, $9,503. W. J. Ford, 17 W. 103d St., *a*, $17,667; *b*, $11,285; *c*, $10,397. Bellew-Merritt Co., Tuckahoe, N. Y., *a*, $18,252; *b*, $10,117; *c*, $7,437. Briggs & McLaughlin, 19 E. 130th St., *a*, $18,240; *b*, $9,910. Jos. M. Stanton, 1341 Webster Ave., *b*, $10,723. T. Gasparrini, *b*, $12,928. Hannan Constr. Co., Williamsbridge, *c*, $5,683. Wilton Constr. Co., Williamsbridge, *c*, $6,096. M. J. Leahy, 990 E. 165th St., *c*, $7,565. Geo. M. Dunn, 737 E. 171st St., *c*, $8,714.

New York, N. Y.—Bids will be received Apr. 5 by John F. Ahearn, Pres. Boro. Manhattan, for furnishing material and constructing sewer and appurtenances in portions of W. 68th St. and B'way. Engineer's estimate: 895 lin. ft., 3 ft. 6 in. x 2 ft. 4 in. brick sewer, 450 cu. yds. rock excavated and removed, 7 cu. yds. brick masonry, laid in cement mortar, etc.

Huntington, L. I., N. Y.—The committee appointed by the Citizens League to consider the construction of sewers is reported to have recommended a septic tank and contact bed system, at a cost of $45,000.

Greenville, N. C.—D. J. Whichard, City Clk., writes that it is proposed to construct a sewerage system, at a cost of $15,000. Address J. L. Wooten, Chmn. Com.

Youngstown, O.—Bids will be received Apr. 7 by the Bd. of Pub. Service (G. T. Prosser, Clk.), for constructing a sewer in a portion of Glenavon St.

Jackson, O.—See "Water."

Cleveland, O.—Bids wil be received Apr. 11 by Alfred R. Callow, Secy., Bd. Pub. Service, 105 City Hall, for constructing sewers in portions of Euclid and Lake Aves.

The following are the bids opened on Mar. 23 by the Bd. Pub. Service mon constructing sewers on Detroit and Edgewater Sts. and Highland Ave.: W. J. Townsend Co., $16,835; Reserve Constr. Co., $20,917; Beers & Doolittle, $21,365; C. Burkhardt, $25,447; A. F. Helm, $25,833; Clements Bros. Constr. Co., $26,009; J. Duff & Co., $30,497; C. T. McCracken Co., $30,703, and J Connelly Constr. Co., $41,324.

Norwalk, O.—It is stated that some new sewers are to be constructed here in the near future.

Girard, O.—E. L. Hauser, City Clk., writes that it was voted on Mar. 21 to issue $30,000 bonds for sewers.

Cincinnati, O.—Local press reports state that an agreement has about been reached between Solicitor Hunt, City Engr. Breen, of this city, and City Engr. Stewart, of Norwood, by which Norwood will be allowed to connect its sewerage system with the proposed Bloody Run sewer, to be constructed from its present terminus to Millcreek, provided that Norwood will take care of the sewage from the east end of Cincinnati. A bond issue will be required to pay for the new Bloody Run sewer, which will cost about $225,000.

Alliance, O.—It is stated that bids will be received Apr. 6 by the Bd. Pub. Service (C. C. Baker, Pres.), for constructing the Summit St. storm sewer.

**Items marked thus give the names of parties awarded contracts.*

Toledo, O.—It is stated that bids will be received until Apr. 10 by the Bd. Pub. Service (Harry S. Jones, Secy.), for constructing several sewers.

Chicago, O.—The Riggs & Sherman Co., of Toledo, are the engineers for a sewerage system for this place.

Blackwell, Okla. Ter.—Bids will be received by Geo. Hines, City Clk., Apr. 14. for constructing a sewerage system. Burns & McDonnell, Engrs., 509 Dwight Bldg., Kansas City, Mo.

Portland, Ore.—City Engr. Wanzer is reported to have completed plans for the Irvington District sewer, and estimates the cost at about $101,000.

Pittsburg, Pa.—See "Paving and Roadmaking."

Brooklyn, N. Y.—The following is the correct list of bids opened on Mar. 15 by Martin W. Littleton, Pres. Brooklyn Boro for a sewer on 67th St. from 2d to 3d Ave., with outlet sewer on 3d Ave., etc. (bidders of Brooklyn, unless otherwise mentioned)—(*a*) Thos. O'C. Sloane, N. Y. City; (*b*) Donegan & Redmond; (*c*) Sigretto & Maurino; (*d*) T. J. Murray; (*e*) Jas. Reiley; (*f*) Murphy Bros.; (*g*) Jas. H. Holmes & Co.; (*h*) Borough Constr. Co.; (*i*) Dewitt C. Bowker, Jr., Rockaway, L. I.; (*j*) Henry Newman.

Reinforced Concrete Sewer.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
290 lin. ft. 42-in.	$14.05	$12.22	$15.00	$15.75	$10.75	$15.30	$15.00	$9.75	$20.00	$15.50
266 lin. ft. 36-in.	5.44	5.70	6.30	7.25	9.00	6.75	7.00	8.75	9.00	6.90
1665 lin. ft. 30-in.	4.78	4.75	5.30	6.25	6.80	5.95	6.00	7.90	8.00	6.44
Pipe Sewer.										
45 lin. ft. 15-in.	1.60	2.50	1.20	3.00	2.00	2.40	3.00	3.00	2.00	2.48
710 lin. ft. 12-in.	1.30	1.40	1.20	1.25	2.00	1.10	2.00	1.40	1.50	1.70
27 manholes	40.00	42.00	45.00	50.00	55.00	40.00	45.00	57.00	40.00	45.00
.5 sewer basins	121.00	135.00	115.00	140.00	155.00	108.00	100.00	140.00	130.00	150.00
13.5 M. ft. foundation plank	20.00	20.00	18.00	20.00	.01	18.00	19.00	20.00	.01	20.00
54 cu. yds. concrete cradle	5.00	.01	.01	1.00	.01	2.05	5.13	8.00	.01	2.50
Total	$16,700	16.154	$17.790	$20,298	$20,604	$19,002	$70,006	$22,378	$24,400	$20,742

Sayre, Pa.—The Secy. to Council writes that the question of constructing a sewerage system will be submitted to a vote of the taxpayers.

Harrisburg, Pa.—It is stated that bids will be received until Apr. 5 for constructing Penn Ave. sewer. J. Austin Brandt, Comr. Highway Dept.

Petersburg, Va.—G. B. Gill, City Aud. writes that about $70,000 will probably be expended for paving and sewerage improvements, but nothing definite has yet been done.

Centralia, Wash.—The Council is reported to have under consideration the question of constructing a sewerage system.

North Yakima, Wash.—Ernest McCulloh, City Engr., writes that as an injunction restraining the city from disposing of the sewer bonds authorized by the election Feb. 7 was sustained by a decision handed down Mar. 16 by Judge Rigg, on account of irregularity of election, the contract for sewers advertised to be let Mar. 20, was not awarded, all bids being returned unopened. Proceedings will be renewed at once in the hope to be able to award a contract in time to commence work about Sept. 1st.

Cleveland, O.—The following are the bids opened on Mar. 23 by the Bd. of Pub. Service for constructing the Milford St. sewer; (*a*) Wm. Lehman; (*b*) W. J. Townsend Co.; (*c*) C. Burkhardt; (*d*) A. F. Helm; (*e*) Jas. Duff & Co.; (*f*) Clements Bros. Constr. Co.; (*g*) C. T. McCracken & Co.; (*h*) J. Connell Constr. Co.; (*i*) Beers & Doolittle.

Brick Sewers.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
1,200 lin. ft. 10 E	$11.25	$10.30	$10.50	$11.85	$11,51	$10.85	$11.80	$11.14	$12.34
910 lin. ft. 5 C	4.65	5.10	4.90	4.73	4.91	4.87	5.41	4.75	5.41
600 lin. ft. 4 C	3.94	4.38	4.25	4.00	4.30	4.20	4.56	3.77	3.98
460 lin. ft 3 C	3.00	4.24	3.88	3.43	3.50	3.88	3.70	3.26	3.48
1 br. chamber junction	150.00	185.00	250.00	160.00	250.00	225.00	175.00	200.00	298.00
3,170 lin. ft. 8-in. sub-drain	.18	.15	.35	.25	.15	.35	.35	.60	.60
350 cu. yd Port. cement concrete	3.50	3.80	3.50	3.00	3.65	4.75	4.00	5.25	5.80
28 M. ft. grillage	20.00	18.00	20.00	18.00	15.00	20.00	21.00	22.00	24.00
15 M. ft. pine invert	20.00	18.00	20.00	16.00	20.00	20.00	18.00	22.00	21.00
150 M. ft. plank and timber	1.00	12.00	14.00	12.00	12.50	16.00	12.00	16.00	18.00
208 lin. ft. C. B. pipe	.60	.75	.50	.50	1.00	.50	.60	1.00	1.00
16 12-in. junction, ea	.75	1.00	1.00	1.00	1.25	.50	1.00	1.50	1.00
160 6-in. junction, ea	.20	.35	.30	.35	.40	.35	.30	.25	.60
12 catch basin, ea	40.00	38.00	38.00	35.00	40.00	38.00	37.50	40.00	38.00
12 manholes, ea	40.00	39.00	38.00	35.00	40.00	38.00	37.50	40.00	37.50
Total	$27,092	$27,319	$28,048	$28,068	$28,365	$29,123	$29,987	$30,015	$32,889

Milwaukee, Wis.—Bonds are reported to have been sold to be used as follows: $100,000 for west sewerage; $50,000 for south sewerage; $30,000 for east sewerage; $200,000 for street improvements; $190,000 for parks, and $50,000 for an isolation hospital.

Beloit, Wis.—City Engr. Caldwell is stated to have completed plans for sewers in the 3d ward, the Fairbanks-Morse sewer and the enlargement of the downtown storm water sewer to cost in all about $7,000.

**Brandon, Man.*—W. H. Shillinglaw, City Engr., writes that the Laclede Fire Brick Mfg. Co., of St. Louis, Mo., has secured the contract for sewer work, bids opened Mar. 1, as follows: 15,000 ft. 8-in. sewer pipe, 21.5 cts. per ft., and 630 branches, 84 cts. ea., delivered f.o.b. Brandon.

Parral, Mex.—Nelson Rhoades, Jr., of the firm of O'Brien & Rhoades, Consulting and Contracting Engrs., of Denver, Colo., is reported to be at Parral preparing plans and making surveys for the construction of a sewerage system for the drainage and carrying off of the flood waters of that city. The plans are to be ready in May.

Renfrew, Ont.—It is stated that bids will be received until Apr. 10 for 7,500 ft. of 6 and 8-in. sewer tile and 220 6 and 8-in. single junctions. J. K. Rochester, Town Clk.

Indian Head, N. W. Ter.—See "Power Plants, Gas and Electricity."

BRIDGES.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—Bids will be received by Julian Kendrick, City Engr., Apr. 15, for reflooring the 21st St. viaduct.

Denver, Colo.—Bids, including plans and specifications, will be received by the Bd. Pub. Wks. (G. E. Randolph, Pres.) until Apr. 26 for constructing a 2-span reinforced concrete bridge, 170 ft. long, of the Melan arch type, including approaches, across Platte River at W. Colfax Ave. Bids are to include the removal of the old bridge and its foundations, as advertised in The Engineering Record.

New Haven, Conn.—Bids will be received by C. W. Kelly, City Engr., on Apr. 10 for constructing a bridge and approaches on Kimberly Ave., over northeasterly branch of West River, as advertised in The Engineering Record.

**Chicago, Ill.*—W. M. Hughes, Consulting Bridge Eng'r., 401 La Salle Sta., writes that the contract for a double track Page Bascule, with a single leaf of 150 ft., to be constructed over south fork of Chicago River, has been awarded to the American Bridge Co., for the superstructure, and to Thomas Phee & Co., for the substructure. This is to replace a swing bridge used jointly by the Chicago & Alton Ry., the Atchison, Topeka & Santa Fe Ry. Co., and the Illinois Central R. R.

Algona, Ia.—Bids will be received Apr. 5 by the Bd. Co. Supervs. for furnishing material and constructing 4 steel bridges as follows: an 84 ft. bridge over Buffalo Creek in Portland Township, a 70 ft. bridge over Prairie Creek in Prairie Township, a 60 and 70 ft. bridge over Lott's Creek in Whittemore Township. L. E. Potter, Co. Aud.

**Des Moines, Ia.*—The City Council is stated to have awarded to Wm. Horrabin, of Iowa City, the contract for constructing 2 retaining walls of re-inforced concrete and 2 re-inforced arches 70-ft. spans for the 6th Ave. Bridge, at his bid of $29,900.

Elk River, Minn.—Bids will be received until Apr. 7 by the Com. at Elk River for constructing a bridge across Mississippi River, as advertised in The Engineering Record.

Lincoln, Neb.—It is stated that bids will be received on Apr. 5 by the Co. Comrs. for constructing a bridge across Spillman Creek.

Paterson, N. J.—It is stated that bids are wanted Apr. 3 by the Com. on Main St. Bridge of the Bd. Chosen Freeholders (Paul VanWyck, Chmn.) for repairing north abutment and south pier of said bridge.

New York, N. Y.—Bids will be received until Apr. 11 by Geo. E. Best, Comr. of Bridges, for the partial reconstruction of the Manhattan Terminal of the Brooklyn Bridge; also on same date for the construction of the University Heights Bridge and approaches, across Harlem River, from 207th St., Manhattan, to 184th St., Bronx Boro.

**Buffalo, N. Y.*—The contract for constructing the substructure of the Ohio St. bridge has been awarded to Bardol & Roberts, D. S., Morgan Bldg., for $59,260. Geo. H. Norton, Asst. Engr. Dept. Pub. Wks.

New York, N. Y.—The Bd. of Aldermen and Mayor adopted the ordinance providing for an issue of $200,000 corporate stock for the reconstruction of the westerly or Manhattan Terminal of the Brooklyn Bridge.

Brooklyn, N. Y.—See "Electric Railways."

Carrington, N. D.—Bids will be received Apr. 5 by the Co. Comrs., for constructing two combination steel and iron bridges, on steel tubular piling, one over James River, and the other over Pipestem Creek. C. M. Porter, Co. Aud.

Cleveland, O.—The following are the bids opened on Mar. 20 by the Bd. of Pub. Service for furnishing material and constructing superstructure of a steel highway bridge on Detroit St. over the tracks of the N. Y. C. & St. L. Ry.: Hunkin Bros. Constr. Co., Cleveland, $17,890; Natl. Iron & Wire Co., Cleveland, $18,076; Forest City Steel & Iron Co., Cleveland, $18,412; Variety Iron Wks., Cleveland, $18,958; King Bridge Co., Cleveland, $19,381; Huston & Cleveland, Columbus, $19,903; West Va. Bridge & Constr. Co., Wheeling, W. Va., $22,241, and John P. Cowing, Cleveland, $23,649. All bids are reported to have been rejected.

It is reported that bids for the superstructure of the Detroit St. bridge will again be received on Apr. 10 by the Bd. Pub. Service (A. R. Callow, Secy.).

Bids will be received Apr. 19 by the Bd. of Co. Comrs. (Julius C. Dorn, Clk.), for constructing steel bridges in Independence; also abutments in Royalton.

Cleveland Heights, O.—Bids will be received by Wm. G. Phare, Village Clk., 402 American Trust Bldg., Cleveland, Apr. 25, for furnishing material and extending concrete arch on Euclid Heights Boule. The Wm. H. Evers Eng. Co., Engrs., 237 Arcade Bldg., Cleveland.

**Shamokin, Pa.*—The York Bridge Co., of York, is stated to have received the contract for constructing a bridge in Shamokin for $21,000.

Safe Harbor, Pa.—See "Railroads."

**Harrisburg, Pa.*—The Bd. of Pub. Bldgs. and Grounds is stated to have awarded on March 23d, contracts for constructing the following bridges: Catawissa, Penn Bridge Co., Beaver Falls, $124,900; Catawissa Creek to Nelson & Buchanan, of Chambersburg, for $67,500; Shumanstown, to the National Bridge Co., of Philadelphia, for $26,250, and Nescopec, to the King Bridge Co., of Cleveland, O., for $20,950.

**Galveston, Tex.*—Mr. Felt, Ch. Engr. of the Santa Fe R. R. is stated to have awarded the contract for work on the superstructure of a bridge over Sabine River for the Jasper & Eastern R. R. Co. The railroad company to furnish part of the material, probable cost of the improvement is $100,000.

**Hinton, W Va.*—P. K. Shrake is stated to have received the contract for constructing substructure of a bridge over New River, for $50,000.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—Bids will be received Apr. 17, extension of date by R. S. Williams, City Treas., for paving sidewalks with Schillinger or hexagon block on portions of Virginia and Jefferson Davis Aves., and Jefferson St.

Denver, Col.—The House of Representatives is stated to have passed bills providing for the following appropriations: $6,000 for repair of state road between Denver and Grand Junction; $4,500 for a road in Summit County; $10,000 for a road in Eagle County; $4,000 for a wagon road in Grand and Boulder Counties, and $10,000 for a road in Larimer County.

Bozrah, Conn.—Bids will be received Apr. 5 by the Bd. of Selectmen (John H. Miner, Chmn.) of the Town of Bozrah, for grading and constructing a section of road. Plans on file at the office of the State Highway Comr., Hartford.

New London, Conn.—Alton T. Miner, Chmn. St. Com., writes that the only bid received and opened on Mar. 23, for constructing a macadam road in the town was that of the Lane Constr. Co., of Meriden, at $1.43 per ft., all trap rock, and $1.05 for native stone.

Jacksonville, Fla.—The Bd. of Pub. Wks. is reported to have opened on Mar. 20 the following bids for grading and laying 43,730 sq. yds. cement gravel and 36,120 lin. ft. wood curbing (price given per sq. yd.): The Southern Fuel & Supply Co., 68¼ cts.; Wm. T. Cotter, 64¾ cts.; Bryan & Co., 69 cts.; G. R. Foster, Jr., 65 cts., and F. W. Long, 64½ cts., bidders all of Jacksonville.

Bloomington, Ill.—Bids are wanted Apr. 6 for 9,603 sq. yd. of asphalt pavements on portions of Groye and Wood Sts. and Morris Ave. Elmer Folsom, City Engr.

Chicago, Ill.—See "Sewerage and Sewage Disposal."

Belleville, Ill.—Henry F. Merker, City Engr., is preparing plans for paving N. Illinois St.; about 12,000 sq. yds. brick paving and 4,000 ft. of curb will be reauired.

East St. Louis, Ill.—Plans are being prepared for the grading, paving and sewering of 2d St. and Cleveland and St. Clair Aves.

**Moline, Ill.*—The Tri-City Corr Davenport, Ia., has secured the 4,500 sq. yds. brick paving on 17th S

Danville, Ill.—It is stated that bi ceived until Apr. 6 by the Bd. L for curbing and paving on Collett

. *Shelbyville, Ind.*—The City Coun to have decided to purchase a stean According to reports, contract will

Rensselaer, Ind.—Bids will be the Bd. of Co. Comrs., Apr. 17, for gravel roads, known as Independen non Branch and Central Gillam B 13½ miles. Jas. N. Leatherman,

Evansville, Ind.—Bids are wante paving various streets. Capt. C. Pres. Bd. Pub. Wks.

South Bend, Ind. The following opened on Mar. 15 by the Bd. P paving on 6-in. found. and Portland —a, Monroe St., 9,526 sq. yd. with *b*, Hill St., 18,225 sq. yd., with Hoban & Roach, South Bend, *a*, $1 Michaels & Minich, Marion, Ind., $1.86. Siders & Co., South Bend, $1.30. James Nelson, South Bend, $1.38. C. H. Defrees, South Be (awarded contract); *b*, $1.22 (award

Louisville, Ky.—The Bd. of P stated to have decided to pave wit remaining portion of Frankfort A

New Orleans, La.—City Engr. stated to have prepared plans and for improving Tulane Ave., at a pro $100,000.

**Fall River, Mass.*—Beattie & stated to have received the contr structing granolithic sidewalks in at $1.47 per sq. yd., probable cost ment, $10,000.

Detroit, Mich.—Bids will be re Apr. 4 by the Dept. Pub. Wks. (V bury, Comr.) for furnishing 3,0 crushed stone for street paving pur

Mankato, Minn.—Bids will be r Apr. 18 by the Bd. Pub. Wks. for brick on portions of several stree tised in The Engineering Record.

Duluth, Minn.—City Engr. M stated to have estimated the cost of creosote blocks on 1st. St. at $55,6

St. Joseph, Mo.—It is stated that received until Apr. 8 by Peter A Surv., for constructing a macadam approximately $23,000.

**South Orange, N. J.*—M. A. Village Clk., writes that contracts (bids opened Mar. 20) have been aw lows: To Donato Tusco, Montclair, yd. Telford broken-stone pavement Pl., 87 cts. per sq. yd., and same c Charlton Ave., 7,170 sq. yd. broke ment, 79 cts.; 1,750 sq. yd. Belgia ter, $1.87, and 950 lin. ft. curb rese Ludwig Batt, South Orange, for broken stone pavement on Kingma cts., and 2,330 sq. yd. on Hamilt and for 1,160 sq. yd. brick gutter, lin. ft. curb reset, 25 cts.

New Brighton, S. I., N. Y. Bid received Apr. 11 by Geo. Cromwell Richmond, for furnishing material grading and paving with macadam College Ave., for repaving with portions of 4 streets; for repavi rified brick a portion of Broad St., paving with granite block a portion engineer's estimate: 10,150 sq. yd 19,700 sq. yds. asphalt block; 4,200 crete; 9,000 lin. ft. 16-in. new curl lin. ft. 20-in. new curbstone; 3, excavation; 7,750 sq. yds. vitrified sq. yds. granite block, etc.

Bids will be received until Apr. tisement) by Geo. Cromwell, Pre Boro., for furnishing material and vitrified brick on concrete on a po Ave. Engineer's estimate: 6,640 sq. brick, 3,000 lin. ft. curb, 850 cu. etc.

Syracuse, N. Y.—Bids will be r 3 by the Bd. of Contract and Su nishing material and paving a port ilton St. with sheet or block asp vitrified brick or block, requiring a guarantee of 10 years. Geo. J. Me

Brooklyn, N. Y.—Bids will be r 12 by Martin W. Littleton, Boro. P nishing material for regulating, g ing, paving and repaving portions streets; enginerr's estimate: 59,560 phalt pavt.; 50,570 lin. ft. new cur ft. old curb, reset; 26,150 sq. ft. pavt.; 72,575 sq. ft. cement sidewalk yds. concrete; 20,644 sq. yds. earth sq. yds. excav.; 2,120 sq. yds. block 17,663 lin. ft. curb. set in concret yds. old stone pavt., etc.

Wellsville, N. Y.—F. M. Leon Clk., writes that about 2,500 ft. of will be laid this summer.

**New York, N. Y.*—The following opened on Mar. 24 by the Dept. of ries for furnishing all labor and quired for repairing asphalt paveme and East Rivers, together with al dental thereto: Uvalde Asphalt P B'way, $112,000; Sicilian Asphalt Times Bldg., $111,000; Barber A Co., 114 Liberty St., $112,850, Constr. Co., 137th St. & Madison A

**Albany, N. Y.*—The following bid ed to have been opened on Mar. with block asphalt about 14,500 sq. Pear St.—*a*, blocks placed on edge; side, price given per sq. yd.: Denni Rochester, *a*, $3.50; *b*, $2.45. Mu 115 1st St., *a*, $3.28; *b*, $2.41. Came

Items marked thus give the names of parties awarded contracts.*

o. (awarded contract for $49,037), a, $2.29. M. F. Dollard, 86 State St., b, $2.40. Hastings Pavement Co., a, $2.43, and Barber Asphalt Paving Cohoes, a, $3.43; b, $2.52.

ill be received Apr. 3 by the Bd. of and Supply for furnishing material and g Livingston Ave., by grading, curbing ing roadway with macadam, repairing ng sidewalks with flags and vitrified uilding receiving basins and laying a pipe sewer under the south sidewalk. Vachsman, Clk.

n, *Neb.*—The following bids are stated been opened Mar. 18 for paving with portions of Holmes, D., S., G., Prospect. and L. Sts. (price given per sq. yd. g): Hugh Murphy, of Omaha, $2.06 for and $2.11 for class B; $.97 for cement d gutter and $.50 for straight curb; Bithulithic Co., of Omaha, $2.08 for and $2.12 for class B; $1.05 for com- curb and gutter and $.50 for straight

le Wash.—The following are the bids opened on March 18 by the Board of Works for and concrete walks on Main St.: (*a*) Sparger Concrete Co., Lumber Exchange; (*b*) lcHugh; (*c*) Hans Pederson. (Bidders all of Seattle.)

	a	*b*	*c*
stimate	$3000.00	$3000.00	$3000.00
im, clearing and Grubbing	6270.00	1500.00	4000.00
cu. yds. earthwork	.38	.35	.37
ft curbs, gutters, etc.	15.50	16.00	16.00
t. crosswalks	15.50	12.00	16.00
q. yds. concrete sidewalks	1.18	1.10	1.18
yds. concrete alley crossings	1.25	1.10	1.25
. catch basins, single inlets	70.00	75.00	75.00
yds. solid rock	.38	1.00	.01
n. ft. 3-in. sewer pipe	.11	.10	.10
. crosswalks to be relaid	5.00	8.00	5.00
t. lumber for bulkead	15.00	18.00	12.60
bs. iron for bulkhead	.04	.05	.06
ft. wooden railing	.10	.10	.10
yds. concrete retaining wall	5.50	7.00	6.00
ft. 24-in. culvert	2.50	2.00	.75
otals	$92,897	$82,828	$88,921

o, O.—C. W. Ryan is stated to have the contract for macadamizing a por- Miami St., for $6,583.

n, O.—Bids will be received Apr. 1 by Comrs. for $50,000 bonds to be used for ting turnpikes. W. J. Shumate, Co.

nt, O.—M. L. Thackelford, City Coun- writes that it is proposed to pave W. with brick, block or asphalt at a cost een $40,000 and $60,000. Geo. Engler,

nati, O.—Bids will be received by the Service (Geo. F. Holmes, Clk.) until for furnishing material and improving of Second Ave. by grading, curbing, izing the roadway, and constructing the drains and retaining wall, etc.

burg, O.—Bids will be received by T. ley, Village Clk., Ajr. 17, for furnish- erial, draining, curbing, grading and izing a portion of Front St., in all

leveland, O.—It is stated that bids will ed Apr. 15 by H. B. Chapman, Village furnishing material and paving with a portion of several streets.

ro, Ore.—It is stated that bids will be Apr. 6 by the Bd. Superv. for grading Hill. Address County Clk.

Pa.—Mayor Gibson is stated to have the ordinances providing for the paving ons of S. Duke St. and College Ave.

own, Pa.—See "Electric Railways."

rg, Pa.—Bids will be received at the the City Comp., Apr. 5, for grading. and paving with asphalt portions of s streets requiring sheet asphalt pav- 80 sq. yds.; block stone, 38,100 sq. yds.; ic sidewalk, 75,000 sq. ft.; excava- 900 cu. yds.; 39,600 lin. ft. sandstone o for constructing sewers in numerous requiring 1,000 ft. 36-in brick, and t. to 24-in. pipe for sewer. Estimated 77,000. Edw. M. Bigelow, Dir. Bd. ks.

burg, Pa.—It is stated that bids will be until Apr. 20 by the Gettysburg Na- rk Comn. (John P. Nicholson, Chmn.) ing and piking avenue on battlefield x 16 ft.

r, Pa.—It is stated that bids will be re- ntil Apr. 3 by M. S. Hatton, Chmn. om., for grading 24th St., and on same S. B. Pennington, Chmn. Com. on Side- or curbing and paving city pavements.

ille, Tenn.—A bill has been passed in ure authorizing the city to issue $50,000 r suburban street construction.

ity Council has passed an ordinance pro- or the paving this year of 1 mile of bitu- ving.

ake City, Utah.—It is stated that bids received until Apr. 10 by the Bd. Pub. concrete sidewalks that may be ordered ity Council. Geo. W. Riter, City Engr.

Utah.—It is reported that bids will asked for the curbing and guttering of ton Ave. from 26th to 34th Sts., to cost

burg, Va.—See "Sewerage and Sewage ."

e, Wash.—The contract for construct- rete sidewalks on Brooklyn Ave. (bids Mar. 18) has been awarded to Isaac Carl- Seattle, for $6,693.

llowing are the bids opened on Mar. 18 alt paving on a 5-in. concrete base—*a*, *b*, 8th Ave.: Barber Asphalt Paving 9,903; *b*, $6,484. Stirrat & Goetz, *a*, , $6,522.

Ft. Worden, Wash.—The lowest bid opened on Mar. 21 by Capt. Geo. H. Penrose, Q.M., U. S. A., Port Townsend, for grading around buildings and constructing road at Ft. Worden, was that of H. J. McInnis, of Port Townsend, at the following bid: 12,600 cu. yds. grading, 30½ cts. per cu. yd.; 100 cu. yds. surfacing, 75 cts. per cu. yd.; 40 ft. tile, 78 cts. per ft.; total, $3,949.

**Tacoma, Wash.*—The Barber Asphalt Co. has secured the contract for paving on North C and other streets, for $105,000. Frank L. Davis, City Engr.

**Racine, Wis.*—P. H. Connolly, City Engr., writes that the contract for paving with brick on Douglas Ave. (bids opened Mar. 4) has been awarded to John O. Jones, 822 9th St., for $28,000.

Milwaukee, Wis.—See "Sewerage and Sewage Disposal."

Beloit, Wis.—Plans have been completed for ½ mile of brick paving and 1½ miles of rock finished streets. Robt. Caldwell, City Engr.

Janesville, Wis.—Bids will be received by the Street Assessment Com. on Apr. 14 for brick paving as follows: W. Milwaukee St., 2,133 sq. yd.; E. Milwaukee St., 3,640 sq. yd., and S. Main St., 4,643 sq. yd. C. V. Kerch, City Engr.

Watertown, Wis.—The following bids are stated to have been received for macadamizing portions of Clyman, 2d and N. Washington Sts., quantities required 6,566 ft. combined curb 15 in., 3,415 ft. combined curb 24 in., 17,304 sq. yds. macadam, 351 sq. yds. cement crosswalks and gutters, etc.: Elzy & Dun, Marshalltown. Ia., $15,753; E. L. Bartlett, Watertown, $16,095; J. A. Heinemann, Chicago, Ill., $17,902; J. R. Quinn, Madison, $18,015; J. Rassmussen & Son, Oshkosh, $18,999; Badger Constr. Co., Milwaukee, $19,216; and Blake Bros., of Madison, $20,234.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Tuskegee, Ala.—The Council is reported to have decided to construct an electric-light plant.

Little Rock, Ark.—The City Council has passed an ordinance granting T. E. Hare, of Vanndale; John B. Jones, of Little Rock, and others, a franchise for a natural gas system.

Colton, Cal.—It is reported that the directors of the Colton Gas Co. will issue $30,000 bonds to improve, extend and enlarge the plant.

Bristol, Conn.—Bids will be received Apr. 12 by the Bristol & Plainville Tramway Co. (Miles Lewis Peck, Pres.) for laying approximately 10 miles c. i. gas main and specials here.

Washington, D. C.—Bids will be received Apr. 25 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of naval supplies as follows: Incandescent lamps, motor, fuses, sockets, pig iron, sheet steel, valves, pipe fittings, pipe, cocks, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Bids will be received at the Executive Office of the Comrs. D. C. (Henry B. F. Macfarland, Comr.) on Apr. 8 for 1-year and 3-year contracts for lighting streets and roads with incandescent gas lamps; also on same date for 1-yr. and 3-yr. contracts, using incandescent mantle naphtha lamps, both advertised in The Engineering Record.

**Jacksonville, Fla.*—The Aultman & Taylor Machinery Co., of Mansfield, O., is stated to have received the contract for a boiler for the city electric light plant for $4,300.

Gainesville, Ga.—The North Georgia Electric Co. is reported to have decided to commence at once the construction of a dam at Wilson Shoals, on Chattahoochee River. It will cost about $150,000. W. A. Carlisle, Ch. Engr., Gainesville.

Chicago, Ill.—It is stated that the Chicago Edison Co. is about to erect a sub-station at 8284 Market St. from plans of Shepley, Rutan & Coolidge, 84 Van Buren St. It will be 2 stories high, 48x100 ft. of brick and stone, and cost $75,000.

Lebanon, Ind.—It is reported that Cropsey & Lamm, Groton Bldg., Cincinnati, O., are preparing plans for an electric and cold-storage plant to be constructed at Lebanon.

Muncie, Ind.—The Citizens Electric Light Co. has been incorporated with a capital of $200,000 by W. F. Warner, H. J. Keller, C. R. Hathaway and others, to construct an electric light plant.

Boone, Ia.—It is reported that the Boone Gas Co. will enlarge its plant and extend the mains.

Conrad, Ia.—W. J. Stanton is interested in the construction of an electric light plant.

Winterset, Ia.—The Des Moines Heat, Light & Water Co., of Des Moines, is reported to be considering the advisability of putting in a central heating plant and water works at Winterset, at a cost of $60,000.

Baltimore, Md.—Plans have been completed by the Baltimore County Water & Electric Co. for a power house to be erected at Herring Run. S. W. Cooper, Highlandtown, is chief engineer and superintendent.

Mansfield, Mass.—At the town meeting Mar. 20 it was voted to extend the electric lighting system to West Mansfield station.

Holyoke, Mass.—Press reports state that the following are the bids opened on Mar. 20 by W. H. Snow, Mgr. of the City Gas & Electric Light Dept., for a new gas-holder: Cruse-Kemper Co., Philadelphia, Pa., holder in steel tank (capacity 750,000 cu. ft.), $52,750, concrete tank $32,950; Deily & Fowler, of Philadelphia, Pa., holder in steel tank (755,000 cu. ft.), $54,800; Bartlett, Hayward & Co., Baltimore, Md., masonry tank (751,000 cu. ft.), $40,000, with additions $2,188 extra, holder in steel tank (same capacity), $60,000; Riter-Conley Mfg. Co., Pittsburg, Pa., holder in steel tank (750,000 cu. ft.), $65,770 (with steel stairway around tank); R. D. Wood & Co., Philadelphia, Pa., holder in steel tank (753,000 cu. ft.), $51,200, extra handrails $350; if city will furnish steam at 90 lb. pressure, $650 will be deducted; same firm will furnish holder in masonry (tank to be built by city), $33,750, with extras for stairway $680, and handrails $350; if city furnishes steam for construction $300 will be deducted.

Mendon, Mich.—The citizens are reported to have voted to issue $15,000 bonds for water works and an electric-light plant.

L'Anse, Mich.—It is stated that $10,000 bonds will be issued to be used for the construction of an electric light plant. Philip Voetsch, Village Pres.

Waconia, Minn.—It is reported that the citizens have voted to construct a lighting plant.

Morristown, Minn.—F. H. Wilkowske, Village Recorder, writes that it is not proposed to construct a gas plant. The village has just purchased gas lamps.

Walker, Minn.—Bids will be received Apr. 17 by the Village Council (Chas. Kinkele, Pres.) for $4,000 bonds issued for the removal and extension of the electric-light and water plant.

Gulfport, Miss.—The City Council is reported to have passed an ordinance granting Capt. J. T. Jones and associates a 50-yr. franchise for an electric railway light and power plant.

Laconia, N. H.—Massachusetts and Rhode Island capitalists have purchased the plant of the Laconia Electric Light Co. and will enlarge it.

J. G. Quimby, Chmn. St. Lighting Com., writes that the Laconia Electric Light Co. has secured the contract for lighting the city for a period of 10 yrs. (bids opened Mar. 27), for about $7,000.

Dunellen, N. J.—Col. Edwin W. Hine, 29 Exchange Pl., Jersey City, representing the Public Service Corporation, is stated to have petitioned the Borough Council for a franchise to lay pipe through the town.

**New York, N. Y.*—The following are the bids opened on Mar. 27 by C. B. J. Snyder, Supt. School Bldgs., for electric equipment for School No. 64, Manhattan Boro.: Peet, McAnerney & Powers, $14,983; W. M. Sheehan & Co., 136 Liberty St., $14,437 (awarded contract); Commercial Constr. Co., $15,123; Reis & O'Donovan, $14,980, and T. Fred. Jackson, $15,549.

**Mechanicsville, N. Y.*—The Hudson River Water Power Co. (Eugene L. Ashley, Pres. Glens Falls), is reported to have contracted to furnish the N. Y. Central & Hudson River R. R. with power for 25 years. Power will be delivered in July from Spier's Falls and Schoharie Falls, together with current from a temporary steam plant to be erected at Utica. It is further reported that the company will now complete its plans for utilizing the waters of Schoharie River. One plant has already been built and 4 more will follow.

Ft. Caswell, N. C.—Bids will be received by Lieut. R. H. Williams, Q.M., U. S. A., on Apr. 11 (readvertisement) for wiring gymnasium here as advertised in The Engineering Record.

Graham, N. C.—Bids will be received by Henry A. Pressey, C. E., 1416 F St., Washington, D. C., on Apr. 12 for constructing water works and an electric light plant at Graham, as advertised in The Engineering Record.

Galion, O.—The Crawford Gas & Electric Co., of Galion, is reported incorporated, with a capital of $150,000, by Selwyn N. Blake, P. P. Jenks, and others.

Salem, Ore.—H. D. Wagnon, an attorney of Portland, is reported interested in the construction of an electric-light and power plant at Salem.

Wellsboro, Pa.—It is stated that the Wellsboro Electric Light Co. will erect a power plant here this summer. W. S. Culver is superintendent.

Greenwood, S. C.—It is stated that bids will be received until Apr. 4 by the Comr. of Pub. Wks. for electrical equipment. A. J. Sproles, Supt. Water and Electric Light Plant.

Bristol, Tenn.—The City Council has granted to J. Edw. Durham, of Philadelphia, Pa., and Wm. B. Cutter, of Buffalo, N. Y., a franchise to furnish a new water supply and develop Holston River water power for the purpose of furnishing the city with electric power. Engineer J. W. Lockhart, of Bristol, has completed the location of a pipe line 6 miles in length to the Henry Preston Spring, that will give the city a gravity supply ranging from one and one-half to two million gal. of water per day.

Bartlett, Tex.—R. S. Decker is reported to have secured a franchise for an electric light plant.

San Augustine, Tex.—A. A. Sheffield is reported interested in the construction of an electric light plant.

Ft. Worth, Tex.—The City Council is reported to have granted to Judge G. W. Armstrong permission to lay a pipe from the Natatorium Bldg. across Rusk St. to 3d St. It is reported that he will commence at once the erection of a concrete building to be used as a light and power plant; probable cost of improvement is $50,000.

Memphis, Tenn.—The House is reported to have passed a bill providing for the municipal ownership of the lighting plant.

Brady, Tex.—The Brady Water & Light Co. of Brady, has been incorporated, with a capital of $20,000. Incorporators: G. R. White and C. C. Baumgardner.

Luray, Va.—The plant of the Luray Electric Co. has just been completed, and the company is now in the market for fans and motors for alternating-current, 110-volt, 60-cycle single phase.

Norfolk, Va.—It is reported that the Norfolk & Western R. R. Co. (C. S. Churchill, Ch. Engr. Roanoke), will make extensive improvements this spring at Lambert's Point, including the erection of one or more piers with an electric light plant to supply electricity at the R. R. yards at Lambert Point, Norfolk and South Norfolk.

Richmond, Va.—Bids will be received Apr. 4 by the Capitol Bldg. Comm. (A. J. Montague, Chmn.) at the office of the Governor, for installing a heat, light and power plant for the State Capitol Grounds and Buildings. Noland & Baskerville, Archts., Chamber of Commerce Bldg.

Tacoma, Wash.—The City Council has under consideration an offer from the Equitable Finance Co., of Portland, Ore., to construct a hydraulic power plant on Nisqually River, 25 miles from Tacoma, to furnish 5,000-h.p., the city to take the plant when completed. Frank L. Davis, City Engr.

Kelso, Wash.—B. L. Hubbell, Town Clk., writes that a lighting franchise has been granted to the Kelso Water & Light Co., which has just completed its water works.

Harrington, Wash.—Wm. Brodie and Jas. Shaw, of Ritzville, are reported to have petitioned City Council for a franchise for an electric-light plant.

Harrington, Wash.—Wm. Brodie and Jas. Shaw, of Ritzville, have petitioned City Council for a franchise for an electric light plant.

Janesville, Wis.—It is reported that bids will be received until Apr. 24 for lighting the city with electricity for a period of 5 years from the 10th of July. A. E. Badger, City Clk.

Indian Head, N. W. Ter.—John Galt, of Toronto, Ont., estimates the cost of constructing water works, a sewerage system and electric-light plant, at $135,000.

Quebec, Que.—The Quebec Ry., Light & Power Co. (E. A. Evans, Ch. Engr., Quebec) is reported to have decided to construct a dam on Montmorency River at the foot of the Natural Steps; it will be 90 ft. high, 12 ft. wide at top, and 65 ft. wide at bottom.

The Quebec Jacques Cartier Electric Co. (L. Denis, Ch. Engr., Quebec) is stated to have decided to construct an additional dam. Total cost of improvements contemplated by both companies reported to be $250,000.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—The construction of an electric railway from Little Rock to Hot Springs is reported under consideration. L. Garrett, A. S. Blodgett and P. M. Pierce, of the Frisco, are reported interested.

Arcata, Cal.—J. E. Green and J. H. O'Brien are stated to have received a franchise to construct an electric railway through Arcata.

San Gabriel, Cal.—The construction of an electric railway from Los Angeles to Riverside and Redlands, completing a belt road which will touch nearly every point of interest in the San Gabriel Valley, is reported contemplated by the Huntington interests.

It is stated that the Pacific Electric Ry. Co. will reconstruct the line of the San Gabriel Rapid Transit Co. between Los Angeles and Monrovia, cutting through Short and what is now known as Dolgeville.

Santa Rosa, Cal.—It is reported that the Petaluma & Santa Rosa R. R. Co. is to extend its line from Green Valley to Forestville.

Oroville, Cal.—A. E. Boynton is stated to have secured a franchise to build and operate a railway between Chico and Oroville.

Salinas, Cal.—M. V. Quigg, Pres. of the Monterey County Gas & Electric Co., is stated to have decided to construct, equip and put in operation an electric railway for passengers and freight traffic between Monterey and Salinas, which will ultimately be extended to Hollister and later into the San Joaquin Valley and Fresno.

Hartford, Conn.—The House of Representatives is stated to have passed a resolution giving to the Hartford & Springfield St. Ry. Co. franchise rights granted to the underlying corporations which have been absorbed by the Hartford & Springfield St. Ry. Co. The subsidiary concerns are the East Windsor St. Ry. Co., the Somers & Enfield Electric Co., and the Windsor Locks Traction Co.

Wilmington, Del.—The Delaware Interurban Ry., with a capital of $500,000, has been incorporated by Benj. F. Meyers, of Harrisburg, Pa., John P. Nields, of Wilmington, and others, to build an electric railway from Wilmington to Elkton, Md., 18½ miles. It will also build a line from Elkton to Perryville, 20 miles.

Kankakee, Ill.—The Kankakee & Western Electric Co., capital $15,000, is reported incorporated to construct an electric railway from

**Items marked thus give the names of parties awarded contracts.*

Kankakee to Milk Grove. Incorporators are John Small, Chas. B. Campbell and Chas. E. Foley.

Covington, Ind.—The City Council has granted a franchise to the Fountain-Warren Traction Co., which proposes to build a line from Lafayette to Danville, Ill., via Covington office of company, Covington.

Muncie, Ind.—It is stated that the Muncie, Hartford City & Fort Wayne Traction Co. will complete a branch line north from Bluffton to Fort Wayne this summer.

Indianapolis, Ind.—It is stated that plans are being perfected to extend the lines of the Indianapolis & Cincinnati Traction Co. to Connersville.

Goshen, Ind.—Tippecanoe Township, Kosciusko County, is stated to have voted a subsidy to the Huntington, Columbia City & Northwestern Traction Co., which will build a line between Goshen and Huntington.

Owensville, Ind.—The citizens of Montgomery Township, in Gibson County, are stated to have voted a subsidy to the Evansville & Princeton Co. for the construction of a line through this part of the county. The extension will start from the company's main line near King's Station, and will run through Owensville and thence in a southwestern direction to the Posey County line.

Des Moines, Ia.—It is stated that Judge Porter, of Eldora, and Mr. Polks, of Des Moines, are considering the construction of a line from Des Moines to Eldora, under arrangements with the Interurban Ry. of Des Moines. This company proposes constructing a line from the Flint Valley line of the Des Moines City Ry. Co., to Saylorville, where connections will be made with the Des Moines-Eldora line.

It is stated that the St. Joseph, Albany & Des Moines Electric Ry. Co. contemplates constructing a line between Des Moines and St. Joseph, Mo.

New Orleans, La.—It is stated that Messrs. Foster and Wight, receivers for the New Orleans Rys. Co., will expend $173,370 on the following contemplated improvements: extension of the power plant, the reconstruction of a part of the Rampart St. roadbed, and 6 new cars.

**Baltimore, Md.*—The contracts for rebuilding and equipping the Pratt St. power house of the United Rys. Co., are stated to have been awarded as follows: Rossiter, McGowan & Co., New York, N. Y., removal of old machinery, L. M. Shoemaker, Philadelphia, Pa., structural steel work of new building, Morgan Engine Co., Alliance, O., 50-ton electric crane, Westinghouse Co., 5000-kw. generator, McIntosh & Seymour Co., Auburn, N. Y., 7500-h.p. engine.

Worcester, Mass.—It is stated that the Worcester & Northern St. Ry. Co. will construct a line from the terminus of the Worcester & Holden line in Jefferson to Wachusett Mountain.

Pass Christian, Miss.—Capt. J. T. Jones, of Gulfport, is stated to have received a franchise to construct and operate an electric railway over the streets of Pass Christian in connection with the proposed line from Biloxi and Gulfport.

Gulfport, Miss.—See "Power Plants, Gas and Electricity."

Schenectady, N. Y.—The Schenectady Ry. Co. will probably commence in the spring constructing the Cohoes and Saratoga extensions. Plans are now in course of preparation. The two extensions as now planned will aggregate 20 miles of road.

Utica, N. Y.—The Utica & Mohawk Valley Railway Co. is stated to have purchased a site near the point where the Rome, Watertown & Ogdensburg R. R. joins the main line of the New York Central R. R. for the construction of its power house. The structure will be 150x150 ft., with a working capacity of 3500 h.p., and a maximum of 6000 h.p.

Brooklyn, N. Y.—Plans and specifications have been completed by the Brooklyn Grade Crossing Com. for section No. 2 of the Brighton Beach R. R. Division. Upon the approval of the Mayor, the Board will receive bids for the work. Section No. 2 starts from a point 300 ft. south of Church Ave. and extends south to Avenue H, a distance of 6,430 ft. This would carry the improvement to a point about 3 miles south of St. Mark's Ave., the beginning of the work. The whole length of the entire line from St. Mark's Ave. is 7 miles. Section No. 2 is to be depressed by means of an open cut 50 ft. wide between concrete retaining walls and of a maximum depth of 18 ft. and an average depth of about 16 ft. The streets will be carried over the cut and double-track railroad by means of steel girder bridges of solid floor construction. The roadways will be asphalted on a concrete foundation, and the sidewalks will be of granolithic construction. The Beverley Road and Avenue C bridges will have a driveway 44 ft. in width; Avenue D, Ditmas and Newkirk, each 34 ft., and Foster, 44 ft. There will be 10-ft. sidewalks on each side of the above-named roadways. The bridges will be supported by two 5-ft. longitudinal girders and designed to sustain a load of 100 lbs. to the square foot. The road is already depressed between Sterling Place and Beverley Road, a distance of 1½ miles. The cost of the whole work for the Brighton Beach Division is $1,976,000.

New York, N. Y.—Metropolitan St. Ry. Co. has asked the Rapid Transit Com. for permission to change the Lexington Ave. route as follows: to turn into Fifth Ave. at 34th St., and into B'way at 23d St., thence to Vesey St. to Greenwich St. to the Battery; thence up Greenwich St. to West B'way, to Fifth Ave. to 23d St., to 8th Ave., to Harlem, into Jerome Ave., to the city line. A subway in Jerome Ave. is preferred by the company.

Eugene, Ore.—R. G. Smith, of Grant's Pass and F. H. Osgood, owner of the Seattle-Renton Electric Ry., are reported interested in the construction of an electric railway from Cottage Grove to Corvallis, via Springfield and Eugene.

Steubenville, O.—The Steubenville, Wellsburg & Wheeling Traction Co. is reported to have under consideration the construction of a line from Wheeling to Middle Ferry, W. Va., and across the Steubenville Bridge to Steubenville.

**Cleveland, O.*—The Cleveland Constr. Co. has the contract for building the 32-mile extension of the Western Ohio Ry. from Lima to Findlay for the Lima, Findlay & Toledo Traction Co.

Zanesville, O.—The Muskingum, Coshocton & Tuscarawas Electric Ry. Co. (Henry Buell, Ch. Engr.), is stated to have under consideration the construction of a line from Zanesville to Coshocton and New Philadelphia.

Celina, O.—Geneva Traction Co. is stated to have secured right of way for a line between Celina and Geneva, a distance of 21 miles.

Pottsville, Pa.—It is stated that the new Shenandoah Electric Ry. Co. has purchased a site in Pottsville for the erection of a car house and depot, and contemplates constructing a line between this city and Shenandoah via St. Clair and Frackville.

McKeesport, Pa.—The Pittsburg & Westmoreland County St. Ry. Co., is stated to have received a franchise to enter McKeesport.

York, Pa.—Surveys are stated to have been completed for the electric railway of the York County Traction Co. between Hanover and Littlestown.

Shamokin, Pa.—Plans and specifications are stated to have been prepared for the Shamokin Extension Electric Railway between Shamokin and Sunbury. Bids will soon be received for constructing same. The line will cost about $450,000, which amount includes equipment.

Waynesboro, Pa.—The Hagerstown-Waynesboro Electric Ry. Co. is reported to be having surveys made for its proposed line to be about 17 miles long.

Lancaster, Pa.—It is reported that contemplated construction on the New Holland, Blue Ball & Terre Hill St. Ry. Co. will be increased sufficiently to build the extension from Blue Ball to Terre Hill.

Pottstown, Pa.—The Trappe & Limerick St. Ry. Co. (Schuylkill Valley Traction Co.) has resumed work on the extension to this town. Surveys are being made for entrance to town this spring, franchise for which was granted last fall. The town track will require 5,000 sq. yd. paving. The Town Council will probably pave balance of streets, 12,000 sq. yd. Ralph E. Shaner, Boro. Engr.

The Schuylkill Valley Traction Co. is stated to have decided to extend its line from Pottstown to Boyertown.

It is stated that the Pottsville & Reading Trolley Co. will extend its line from Pottstown to West Philadelphia via Rogersford and Valley Forge.

Galveston, Tex.—It is stated that Geo. E. Woodhouse, of the Bloomington & Champaign Electric Ry., of Bloomington, Ill., is interested in the building of an electric railway between Galveston and Houston.

Middlebrook, Va.—T. J. Whalen, of Middlebrook, it is stated; contemplates constructing an electric railway from Staunton to Rockbridge Baths via Middlebrook and Brownsburg, about 25 miles.

Graham, Va.—The Bluestone Traction Co. is reported incorporated, with a capital of $100,000, to build electric railways in Virginia. John Walters, pres., J. N. Sluss, vice-pres., Graham; Edwin Mann, treas., Bluefield, W. Va.

Walla Walla, Wash.—Edwin S. Isaacs is stated to have secured a franchise to construct a street car system in Walla Walla.

Milwaukee, Wis.—The Wisconsin River Traction & Power Co. and the Mathie Bros. Land Co. are reported incorporated, to construct jointly a paper mill at Rothschild at a probable cost of $1,000,000; develop water poyer of Wisconsin River and construct a railway from Wasau to Merrill. Neal Brown, G. D. Jones and Karl Mathie, of Wausau, are reported interested.

Toronto, Ont.—It is stated that the St. Catharines, Niagara & Toronto Electric Ry. Co. contemplates extending its line to Toronto by way of Hamilton; also to construct a line to Ft. Erie.

Hamilton, Ont.—It is stated that the Hamilton, Grimsby & Beamsville Ry. Co. will extend its line to Niagara-on-the-Lake, at the mouth of the Niagara River.

RAILROADS.

Notes Arranged Alphabetically by States.

Helena, Ala.—Maj. E. C. Finley, of St. Louis, Mo., a director of the Helena, Tupelo & Decatur R. R., and R. H. Phillips, C. E., of St. Louis, Mo., are reported to be making preliminary arrangements for a final survey for the proposed line.

Apalachicola, Fla.—R. B. Coleman, of Bainbridge, Ga., is reported to be Supt. of Construction of the Apalachicola & Northern Ry. Co., and it is stated that work wll begin at once at Apalachicola. The road will be constructed from Apalachicola to Quincy, Fla., and to Bainbridge, Ga.

Mt. Ayr, Ia.—Mt. Ayr Township is stated to have voted on Mar. 22 a 5 per cent. tax to the St. Joseph, Albany & Des Moines R. R. Co.

Sioux City, Ia.—A survey is reported to have been made by the Chicago Great Western R. R. Co. (A. Munster, Ch. Engr., St. Paul, Minn.), for a line from Arispe, Ia., to Carroll, Ia. Right of way and property for terminals have already been purchased. The survey runs through Creston, Greenfield and Guthrie Centre. It is the intention to build the line on to Sioux City.

Shubuta, Miss.—Authority has been asked for a charter for the Shubuta & Southwestern Ry. to run from Shubuta in a southwesterly direction about 12 miles. D. N. Heidleberg, of Shubuta, Miss., is reported interested.

New Orleans, La.—The charter of the New Orleans Great Northern R. R. Co., the organization which has taken over the East Louisiana R. R., is being formally published. F. H. Goodyear, Pres. of the Great Southern Lumber & R. R. Co., of Brooklyn, N. Y., is Pres., and C. I. James, Secy. The charter gives it rights to become eventually an initial line of New Orleans and also to extend its main line to the border line of the State, and thence northward to Natchez, Miss. A charter has also been filed in Mississippi for the creation of a terminus in that State. The charter gives company right to construct and maintain passenger and freight terminals in New Orleans and to construct and maintain docks, wharves and shipping facilities, telegraph and telephone lines as an adjunct to its railroad.

Delhi, N. Y.—The Delaware & Eastern R. R. Co. is reported formed with a capital of $600,000, by L. A. Watres, of Scranton, Pa., Pres. Title Guaranty Trust Co., and others, to construct a railroad from the main line of the Ontario & Western R. R. to Delhi, a distance of 51 miles.

New York, N. Y.—Bids will be received by Robt. H. Groff, Secy. Pennsylvania, New York & Long Island R. R. Co., at 85 Cedar St., on Apr. 18 for the construction of tunnels from points near 1st Ave, westward under private property and 1st Ave., 32d and 33d Sts. to points between 6th and 7th Aves., as advertised in The Engineering Record.

Bryan, O.—Press reports state that a mortgage for $4,000,000 has been filed with the recorder of Williams County (Bryan C. H.) by the Toledo, Marshall & Northern R. R. Co. to the Knickerbocker Trust Co., of New York City. The money is to be used in the construction the coming season of a railroad from Montpelier, O., north into Michigan, the final terminus being some point on Lake Michigan.

Wapakoneta, O.—It is reported that as soon as the Western Ohio Ry. Co., disposes of its stock, with which it will build a road from Lima to Findlay, it will take up the matter of an extension of its line south from Minster to Piqua.

Oklahoma City, Okla. Ter.—A charter has been granted to the Oklahoma & Texas R. R. Co., with a capital of $5,000,000, to build a railroad from Oklahoma City southwest through the counties of Oklahoma, Canadian, Caddo and Comanche, and the Chickasaw Nation, to a point on the Ft. Wayne & Denver R. R., either in the county of Clay or Wichita, in Texas; estimated length of the line 200 miles. Incorporators: G. B. Stone, C. B. Ames, and others, all of Oklahoma City. Places of business are Oklahoma City, St. Louis, Mo., and New York City.

**Pittsburg, Pa.*—Contracts are reported to have been awarded to the McClintic-Marshall Constr. Co. by W. H. Brown, Ch. Engr. of the Pennsylvania R. R., for the construction of the steel work for the Duquesne elevated line at a cost of about $500,000. The erection will begin at 3d St. and Duquesne way, and will extend to 11th St., where it will intersect the Pittsburg, Fort Wayne & Chicago line.

Philadelphia, Pa.—The plans for the elevation of the tracks of the Philadelphia & Reading Ry. Co. on 9th St., as revised by Chief Webster, of the Bureau of Surveys, and Wm. Hunter, Ch. Eng. Philadelphia & Reading Ry., are stated to have been approved by the Mayor and Geo. F. Baer, Pres. P. & R. R. Co. The estimated cost of the 9th St. elevation is about $6,000,000, of which the railroad will pay $3,000,000. It will be necessary for the city to raise about $2,000,000 to begin the work. The plans also provide for extensive improvements between the Terminal here and Wayne Junction.

Safe Harbor, Pa.—Press reports state that the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia), is preparing plans for the erection of a new bridge over the Susquehanna River at Safe Harbor on the Columbia & Port Deposit division, to replace the one recently washed away. It will also be necessary to reconstruct the line at that point and raise the tracks 5 or 6 ft. above present level; total cost of improvements reported to be $50,000.

Greenville, Pa.—The Bessemer & Lake Erie R. R. Co. (H. T. Porter, Ch. Eng., Greenville), is stated to have decided to expend about $250,000 in new tracking; also $25,000 for new repair shops to be erected at Greenville

Port Arthur, Tex.—The charter of the Port Arthur & Houston Short Line has been filed with the Secy. of State providing for the construction of a railroad from Port Arthur to Houston, about 90 miles. Principal office to be at Port Arthur; capital, $200,000. F. J. Hart, Pres.; J. P. Ward, Vice-Pres.; F. F. Shipp, Secretary, all of St. Louis, Mo.

Urbanna, Va.—The Urbanna Constr. Co. is reported incorporated to build the Rappahannock & Eastern Ry., running from Richmond to Urbanna; capital. $100,000. F. H. S. Morrison, Pres., Newark, N. J.; W. J. Maher, Secy., Brooklyn, N. Y.

Roanoke, Va.—The directors of the Norfolk & Western R. R. Co. (C. S. Churchill, Ch. Engr., Roanoke) are reported to have authorized the expenditure of about $500,000 for im-

**Spokane, Wash.*—The directors of the Spokane & Inland Ry. Co. are stated to have awarded to Porter Bros., of Spokane, the contract for grading 22 miles of the Graves line, from the city limits southerly to Rock Creek.

**Charleston, W. Va.*—C. P. J Charleston, Ch. Engr. Imboden & C Co., writes that the contract for cons 11-mile extension to the line on Blue Va. (bids opened Mar. 1) has been T. J. Cormack, of Charleston, W. V

Mexico City, Mex.—Articles of i for the Rio Grande, Sierra Madre Ry., organized by Col. W. C. Greene, filed here; capital $3,000,000. H will be in Mexico City.

Toronto, Ont.—Bids will be recei by Fred Nichols, Pres. Toronto & H Co., Pacific Bdg., Scott and Fron grading culverts, masonry, bridges work required between Toronto a Falls.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically b

Montgomery, Ala.—It is reporte Legislature has appropriated $60,000 to erect an annex to the Capitol.

Little Rock, Ark.—It is reporte are wanted Apr. 4 for erecting a also for a fire-proof connection bet tories and administration building at sas Deaf Mute Institute. John H. Bd. Trus., State Charitable Inst.

San Francisco, Cal.—It is stated t man Hospital will expend about $320, buildings. Architect, Herman Barth, gomery St.

Marysville, Cal.—Wm. Curlett, P San Francisco, is stated to have pre for a library to be erected here Packard, of Marysville, to cost $75,

New Haven, Conn.—Bids will Apr. 11 by the Bd. of Fire Co Metzger, Secy.) for erecting a fire e on Crown St. Bids will be receive for masonry, carpenter, pumbing work. Brown & Von Beren, Archts., St.

**Washington, D. C.*—G. H. Willia to Supt. U. S. Capitol, writes that for the stone work in connection w tion of the office building for the H resentatives (bids opened Mar. 15 awarded to B. A. & G. N. Williams, 42d St., New York City, N. Y., fo Marble and limestone will be used.

Washington Barracks, D. C.—Bids Apr. 8 for timbrel arch constructio War College, as advertised in The Record.

Bids will be received by Capt. J Sewell, Corps Engrs., U. S. A., on heating apparatus for Army War advertised in The Engineering Reco

McRae, Ga.—Alexander Blair, o is reported, has been engaged to p for the Telfair County Court Hou to cost about $40,000.

Ft. McPherson, Ga.—Bids will be Capt. B. B Buck, Constructing Q.M Apr. 25, for the construction of s rooms and kitchens for 8 companies and band, as advertised in The Engi ord.

Ft. Oglethorpe, Ga.—Bids will be til Apr. 8 by Capt. C. Nixon, Q tanooga, Tenn., for constructing, pl ing and gas-piping a fire apparatu Ft. Oglethorpe, Ga. (Chickamauga

Boise, Idaho.—The Capitol Bldg. reported, is about to purchase the s the Central School stands for the and will probably soon ask bids for

Chicago, Ill.—Richd. Schmidt, 172 St., Geo. Beaumont, 115 Dearborn Holabird, 1618 Monadnock Bldg. ported, have been engaged to prep remodelling the city hall and also structure.

La Salle, Ill.—It is stated that a brary is to be erected here to cost a

**De Kalb, Ill.*—C. W. Gimdele, has secured the contract for con U. S. Post Office at De Kalb Jan. 30) for $64,250.

Indianapolis, Ind.—The Bd. Pub approved plans for a fire house to Raymond and Webb Sts., and ha the Bd. Pub. Wks. to receive bids tion. Probable cost, $15,000.

Kokomo, Ind.—The Co. Comrs. a considering the erection of a new c a cost of $200,000 or the repair o building at a cost of about $50,000.

Sulphur, Ind. Ter.—Bids will May 1 by Jos. F. Swords, Su Springs Reservation, at Sulphur, chase and removal of about 271 and brick buildings, including a 4-story brick structure located o vation.

**Waterloo, Ia.*—The Library Co 20, it is reported, opened bids for 2 Carnegie Libraries, awarding the the East Side structure to C. E. Webster City, for the building wit ment, at $18,867.

The Library Comn. has under the bid of Lauritzson Bros., of Minn., who bid $16,259 for the structure. The bids do not include lighting, contracts for which wil arately.

Vinton, Ia.—It is stated that bi ceived until May 3 for erecting basement stone court-house. Bell Archts., Minneapolis, Minn.; A. H Aud.

Manhattan, Kan.—Geo. A. Berli trice, Neb., it is reported, has bee

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**Items marked thus give the names of parties awarded contracts.*

lans for a court house which is to be ere at a cost of about $50,000.

ley, Kan.—Capt. Leon S. Roudiez,). M., at Ft. Riley, it is reported, has plans and specifications for the con- of a new hospital at this post, esti- cost $125,000.

, *Me.*—Plans prepared by Frank A. of Boston, Mass., for the Public Li- ve been accepted. There is $126,000 for the purpose.

re, Md.—The following are reported to ids received Mar. 22 by the Bd. of 'or erecting the Fish Market at Centre)ace:
tion.—Crawford Paving Co., concrete, time, 90 days; concrete caisson, $9,700; days. Chas. L. Stockhausen, concrete, 120 days. Broderick & Wind, concrete, 90 days; concrete caisson, $10,000; 90

ructure: (each bid contained certain s)—Henry Smith & Sons, $116,452, time . D. W. & G. H. Thomas, $111,500, 6 Cramp & Co., $103,376, 6 months. J. dan & Co., $123,317, 8 months. C. L. sen, $110,772, 9 months. Milton C. 22,170, 12 months. Tatterson & Thu- 3,333, 10 months. W. H. Wells, $130,- onths. Broderick & Wind, $112,000, 6 C. Sheehan & Son, $123,350, 12 months. ppel, $114,500, 8 months. Penn Bridge ,500, 12 months. C. McCaul Co., $104,- onths. B. F. Bennett & Son, $120,260, . W. N. Hildebrand & Co., $126,965, s.

Indrews, Peddocks Island, Mass.—Bids received Apr. 24 by John E. Baster, ing Q. M., U. S. A., Boston, Mass., ishing material and for constructing, steam heating and electric wiring the brick buildings: A barrack, a double tenants' quarters and one set Field quarters.

Creek Mich.—C. A. Howland, of has secured the contract for erecting . Post Office at Battle Creek for $74,-

sh, Minn.—J. H. Evans & Sons, it is ave received the contract to erect the cture for the Orphanage at about $17,-

ssoula, Mont.—Bids are wanted Apr. 22 ructing a brick storehouse at this post. Robinson, Jr., Ch. Q. M., St. Paul,

Branch, N. J.—Local press reports t the City Council has authorized City ewcomb to receive plans from local only until the second week in April sino, the cost not to exceed $50,000.

York, N. Y.—The following are the ned on Mar. 28 by Nicolas J. Hayes, r., for erecting a building for Engine 6 at Liberty and Greenwich Sts.: Geo. bad, 38 Park Row, $33,790; Lincoln & 460 W. 41st St., $35,888; Fleischman onst. Co., 7 E. 42d St., $36,500; Geo. r Co., Fuller Bldg., $27,856 (awarded ; D. J. Ryan, 723 3d Ave., B'klyn, P. J. Ryan, 314 W. 44th St., $33,608; e, 5 E. 42d St., $37,926; Francis Sulli- E. 125th St., $37,617; Tolmie & Kerr, 30th St., $33,687; Gantz Realty Const. ,015; Wm. Werner, 892 Forest Ave., Waters & O'Connell, 5 E. 42d St., Thos. D. O'Connor, 1123 B'way, $32,- Thos. B. Leahy, 1 E. 42d St., $31,373.

York, N. Y.—It is reported that the Fuller Constr. Co., 137 Broadway, has the contract to erect a fire engine Liberty St. (bids opened Mar. 27) at

ork, N. Y.—Plans have been filed for brick and stone ambulance station, a rick and stone power house and morgue ected at 137th St. and Lenox Ave., at a 200,000 for the City of New York. J. llander, Archt., 244 5th Ave.

N. Y.—The erection of a new build- ake the place of the Buffalo Homeo- ospital, it is stated, is under considera- the Bd. of Trus. Probable cost, $150,-

se, N. Y.—It is reported that the Hos- the Good Shepherd is to be enlarged t of $50,000. Dr. Douglas A. White,

ter, N. Y.—The following are the bids n Mar. 21 by the State Bd. of Armory at Albany, N. Y., for the construction mory at Rochester:
al construction: Nay Aug. Lumber Co., ; Morris Kantrowitz, $203,246; Dennis- ., $174,065; Dean & Havens, $190,480; lerich & Sons Co., $187,777; Mosier & , $199,372; H. F. Edgerton, 211,943; halen & Sons, $196,300; Neiderpruem, chaff Co., $189,000; Peter Keeler Bldg. 8,776; E. C. Rumrill, $218,207; Car- Ford Co., $192,970, and Hudson Valley o., $181,000.
ral steel: Louis F. Shoemaker & Co., Am. Bridge Co., $36,660; Levering, s & Co., $39,933; American Structural ., $37,518; Hay Foundry & Iron Wks., Seneca Eng. Co., $37,300; Belmont ks., $36,438; Buffalo Structural Steel 414; C. F. Ernst's Sons, $38,550; Van n Wks. Co., $36,750; McClintock-Mar- nstr. Co., $38,800, and Hudson Valley Co., $35,490.
eating, (*b*) plumbing: Edw. P. Bates, 5; J. J. Horan & Co., *a* $8,896; J. L. eld, *a* $9,825, *b* $11,950; A. D. Granger $8,876 (boilers only); John W. Dan- ., *a* $11,915; Howe & Bassett, *a* $10,- 11,800; Breen Bros., *a* $8,863; Golding , *a* $11,689; Burleson Hardware Co., , *b* $10,989; H. A. Sanborn, *a* $9,968; Barr & Creelman, *a* $9,178, *b* $10,035; Gaylord & Eitapenc, *a* $9,973; Dean & Havens, *a* $11,828, *b* $11,538; Richd. T. Ford, *a* $8,000; J. S. Goodenow, *a* $7,840; W. N. Tobin, *a* $11,130, *b* $13,500; Edw. Joy, *a* $9,672; Richd T. Ford, *b* $8,600; Timothy McAvoy & Sons, *b* $15,390.

Electricity and gas: Frost & Sheldon, $14,950; John C. Buchanan, $10,500; John Kelly, $11,854; Wheeler, Green Electric Co., $14,947; E. P. Little Elec. Const. Co., $11,712; Edw. Joy, $13,649; Commercial Const. Co., $10,248 and Standard Electric Const. Co., $9,990.

Mansfield, O.—Bids will be received until Apr. 19 by the Bd. Mgrs., Ohio State Reformatory, Mansfield (Fred. S. Marquis, Secy.), for furnishing and installing four 265-h.-p. water-tube boilers of the B. & W. type; also 4 complete automatic stokers for the same. Henry Heer, M. E., Ohio State Reformatory.

Steubenville, O.—Bids will be received Apr. 24 by Geo. P. Harden, Co. Aud., for erecting a county infirmary and boiler house. Fred W. Elliott, Archt., Bd. of Trade Bldg., Columbus.

Cincinnati, O.—Hannaford & Sons, Hulbert Blk., are preparing plans for several buildings for the House of the Good Shepherd on Warsaw Ave., which will include a laundry, power house and stable, and also improvements to the main building, the total cost to be about $60,000.

Gustave Drach, Union Trust Bldg., it is stated, has been engaged by the Bd. Pub. Service to prepare plans for improvements to the House of Refuge to cost about $30,000.

Painesvillle, O.—Geo. F. Hammond, of Cincinnati, it is stated, has been engaged to prepare plans for a court-house which is to be erected, at a cost of $75,000. A jail, costing $75,000, is also to be erected.

West Chester, Pa.—All bids opened on Feb. 21 by the Super. Archt., Treas. Dept., Washington, D. C., for the construction complete of U. S. Post Office at West Chester, have been rejected. The lowest bid received amounted to $35,458.

Lebanon, Pa.—The following are the bids opened on Mar. 27 by the Super. Archt., Treas. Dept., Washington, D. C., for the construction complete of U. S. Post Office at Lebanon: Miller Bros., Lebanon, $43,500; Mankin Constr. Co., Richomnd, Va., $38,689; Chas. McCaul Co., Philadelphia, $41,796; Cramp & Co., Philadelphia, $42,871; Thos. Reilly, Philadelphia, $44,509; Richardson & Burgess, Washington, D. C., $40,633; Fissel & Wagner, New York, N. Y., $37,925, and Broderick & Wind, Baltimore, Md., $35,000.

Pittsburg, Pa.—The erection of a fire engine house in the Squirrel Hill Dist., it is stated, is under consideration. An appropriation of $100,000 has been made to cover the cost of the building and grounds.

Ft. Moultrie, S. C.—Bids will be received by F. M. Cole, Q. M., U. S. A., on Apr. 28, for constructing certain buidings at this post, as advertised in The Engineering Record.

Columbia, S. C.—Bids will be received Apr. 12 by the Commission, for roofing the State Capitol with tile, tin plate and slate. Chas. C. Wilson, Archt., 1302 Main St.

Charleston, S. C.—Bids will be received Apr. 22 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for plumbing and fire mains for building No. 5, navy yard here.

Pierre, S. D.—Bids will be received Apr. 25 by Jas. Knox Taylor, Superv. Archt., Treas Dept., Washington, D. C., for installing a low-pressure steam-heating apparatus in the U. S. Post Office and Court House here.

Savannah, Tenn.—The erection of a new court house for Hardin County is reported under consideration.

Clifton, Tenn.—The erection of a new court-house, at a cost of about $20,000, is reported under consideration.

Sherman, Tex.—The following are the bids opened on Mar. 23 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction, except heating apparatus and wiring and conduit system, of U. S. Post Office and Custom House at Sherman: Dieter & Wenzel, Joplin, Mo., $86,465; John Bond, Ft. Worth, Tex., $88,900; General Constr. Co., New York, N. Y., $83,813; Richardson & Burgess, Washington, D. C., $103,590; F. L. Stevenson Contract Co., Dallas, $80,390; L. Baker, Sherman, $112,107; Buchanen & Gilder, Ft. Worth, $105,620; O. G. Rogerson, Amarillo, Tex., $115,000; Tom Lovell, Denton, $89,802; Latimer & Bennings, Kansas City, Mo., $93,100, and Robt. Butler, Hastings, Neb., $102,000.

Laredo, Tex.—The following are the bids opened on Mar. 21 by the Superv. Archt., Treas. Dept., Washington, D. C., for constructing complete, except elevator and wiring, the U. S. Post Office, Court House and Custom House at Laredo: Johnson & Jeffries, Laredo, $147,500; Buchanen & Gilder, Ft. Worth, $113,115; General Supply & Con. Co., New York, N. Y., $80,795; Kroeger & Rheims, San Antonio, $89,666; Savannah Constr. Co., Savannah, $119,000; J. F. McKnight, Halletsville, Tex., $109,000; F. L. Stevenson Contract Co., Dallas, $103,000; Richardson & Burgess, Washington, D. C., $112,495, and Tom Lovell, Denton, Tex., $101,755.

Charlottesville, Va.—Bids will be received by the Superv. Archt. Treas. Dept., Washington, D. C., on Apr. 24, for a low-pressure steam heating apparatus for the U. S. Post Office and Court House at Charlottesville, as advertised in The Engineering Record.

Seattle, Wash.—The erection of a new city hall is reported under consideration.

Superior, Wis.—The following are the bids opened on Mar. 28 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction of the U. S. Post Office at Superior: Ole H. Oleson, Stillwater, Minn., $169,900; E. A. Dahle Co., Superior, $184,274; E. W. Gindele Co., Chicago, Ill., $168,668; Northern Constr. Co., Milwaukee, $178,000; McCarthy Bros., Chicago, Ill.; $183,825; McLeod & Smith, Duluth, Minn., $186,000; P. M. Hennessy Cons. Co., St. Paul, Minn., $175,500; John Donlin, Superior, $199,740; Schmidt Bros., Superior, $177,738; Newman & Hoy, St. Paul, Minn., $169,200; W. J. McAlpine, Dixon, Ill., $171,600; Bennett-Reeves Co., Minneapolis, Minn., $224,500; W. H. Maxwell, Pierre, S. D., $172,942; Butler Bros., St. Paul, Minn., $180,000; J. W. Miller, St. Paul, Minn., $174,145; and G. H. Sansbury, Duluth, Minn., $185,211.

Milwaukee, Wis.—See "Sewerage and Sewage Disposal."

Toronto, Ont.—The Controllers have appropriated $25,000 for the erection of a sheep pen at the Western Cattle Market.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Sacramento, Cal.—The Novelty Theater Co., it is reported, will erect a theater here, to cost about $50,000.

Berkeley, Cal.—It is reported that the Golden Sheaf Bakery Co. will soon erect a building, to cost $25,000.

San Francisco, Cal.—It is reported that the American Chicle Co. has purchased a site on Bluxome St., and intends erecting a building, to cost $45,000.

It is stated that St. Francis Hotel is to be enlarged, at a cost of $1,250,000. Architects, Bliss & Faville, Crocker Bldg.

San Diego, Cal.—Ralph Granger, it is stated, is contemplating the erection of a 5-story store and office building at 5th and E Sts.

Madera, Cal.—The following are reported to be the bids received by A. C. Swartz, Archt., Fisk Bldg., Fresno, for the erection of the Rosenthal-Kutner Bldg. in this city: Ryan & Minard, $38,400; John Hoffman, $38,631; G. H. Millward, $39,000; I. A. Cowan, $32,800; Chas. J. Lindgren, $33,500; Sibley & Paddock, $40,357. Kutner-Goldstein bid for the plumbing $1,750, heating $2,500, tinning $1,200. The Russel-Vail Co. bid for plumbing $2,428, gas fitting $229, heating $2,929.

Manitou, Colo.—The Manitou Bath House Co. has been incorporated with a capital of $110,000 for the purpose of erecting a bath house on the site of the Norris Hotel. It is to be a 2-story 153x54 ft. white enameled brick and is to cost, including ground, about $110,000. T. P. Barber, of Colorado Springs, is the archt.

Denver, Colo.—Quayle & Rice, of Denver, it is stated, have prepared plans for a sanatorium to be erected for consumptives by the Swedish Hospital Assoc. (E. W. Norlin, Secy.) at a total cost of about $300,000. The main building is to be erected first, and the other 2 buildings as funds are available.

Frank S. Snell, 1517 Tremont St., is said to have prepared plans for a 6-story business building which is to be erected at 15th and Stout Sts., by the W. W. Porter Investment Co. at a cost of $150,000.

Washington, D. C.—U. S. Senator Warner Miller, of N. Y. City, it is reported, is contemplating the erection of an office building in this city, to cost about $1,000,000.

Savannah, Ga.—H. W. Whitcover, 5 Bull St., is preparing plans for a 4-story Masonic Temple which is to be erected at Bull and Chariton Sts.

Rome, Ga.—The plant of the Virginia-Carolina Chemical Co. at East Rome, it is reported, has been destroyed by fire.

Wallace, Idaho.—I. J. Galbraith, of Spokane, Wash., it is reported, has completed plans for a $30,000 lodge building to be erected for the Eagles.

Chicago, Ill.—Jarvis Hunt, Monadnock Bldg., has been intructed to prepare plans for the new bank building to be erected for The American Trust and Savings Bank at Clark and Monroe Sts. The building will be 19 stories high, of pressed brick and stone, and cost $800,000.

Wm. F. Grower will erect a 10-story fireproof mercantile building on Madison St., 110x99 ft., and cost $325,000. Frank J. Braband is the architect.

Armour & Co. will erect an office building in the stockyards for their own use. The building will be of reinforced concrete, and is estimated to cost $250,000.

Mrs. Harriet Blair Borland will erect at La Salle and Monroe Sts. an 18-story office building, 110x60 ft., at a cost of $700,000.

The Chicago Athletic Assoc. has commissioned Richd. E. Schmidt, 172 Washington St., to prepare plans for an addition to the club-house, to cost about $275,000.

Frank E. Newell, 78 La Salle St., has designed a 3-story building for Geo. W. Stewart. It is to be built at Sheridan Road and Galt Ave., and will be 125x115 ft. The cost is estimated at $75,000.

A. E. Colcord, 108 Dearborn St., is the architect of a 3-story building to be built on Indiana Ave. and 57th St. It will be 78x115 ft., and cost $60,000.

Hannah & Hogg are having plans prepared for a 12-story fireproof hotel to be erected on the site of the Brevoort, which was destroyed by fire recently. Probable cost, $500,000.

Horace A. Stocker writes that it is proposed to erect a 2-story building, 48x135 ft. It will be used as a salesroom and warehouse. No power plant will be installed. It will contain a heating plant and an electric elevator 7x12 ft.

Peoria, Ill.—The Leisy Brewing Co. will erect a 6-story office building on Fulton St. and Jefferson Ave. Probable total cost, $250,000.

Rockford, Ill.—The Illinois, Iowa & Minnesota R. R. (I. W. Troxel, Ch. Engr., Chicago), it is stated, will erect a depot here, to cost $20,000.

Dixon, Ill.—The erection of a Y. M. C. A. building at a cost of $30,000 is reported under consideration.

Ft. Wayne, Ind.—The Ft. Wayne & Wabash Valley Traction Co. (M. J. Kehoe, Ch. Engr., Ft. Wayne), it is stated, will erect a $150,000 station here, to be 8 stories high and of fireproof construction.

Logansport, Ind.—John E. Dowling, Mgr. of the Dowling Theater, it is stated, intends making improvements to his present building at an estimated cost of $20,000.

Indianapolis, Ind.—The Jewish men of the city are reported to be contemplating the erection of a club house to cost approximately $30,000.

It is stated that an assoc. has been formed of which Oscar Sherman is secy. for the purpose of erecting a wigwam for the Red Men of the city, the cost to be about $100,000.

The erection of a G. A. R. Memorial Hall at a cost of $25,000, is reported under consideration. The members of Stone River Post G. A. R. are said to be interested.

Sioux City, Ia.—The Elks Bldg. Co., of Sioux City, has been incorporated, with a capital of $50,000, for the purpose of erecting a home here next summer for the Elks.

The Masons of the city are contemplating the erection of a brick and stone club-house at 7th and Douglas Sts., to cost about $50,000.

*John P. Wall, 414 Pierce St., it is reported, has received the contract to erect the Iowa State National Bank Bldg., at $38,790.

Des Moines, Ia.—The Garver Hardware Co. has accepted plans prepared by Proudfoot & Bird, Crocker Bldg., for a 3-story fireproof building which is to be erected at 707 Locust St. and is to cost $45,000.

Des Moines, Ia.—The Des Moines Savings Bank and Marcus Younkers have jointly purchased the Good block, covering a quarter of a block, and as soon as leases expire, will erect a 10-story fireproof office building.

Topeka, Kan.—Woodward & Burgess, owners of theaters in Kansas City, Mo., it is stated, are contemplating the erection of a theater here to cost $80,000.

**Baltimore, Md.*—The J. C. Vreeland Bldg. Co., of N. Y. City, it is reported, has received the contract to erect the Henry Walters Art Gallery at Centre St. and Washington Pl. It is stated that the total cost of the building will be about $500,000.

Worcester, Mass.—It is stated that plans have been prepared for a 6-story brick business building which is to be erected at Mechanic and Commercial Sts. Frank H. Bigelow may be able to give further information.

S. Z. Poli, of New Haven, Conn., has purchased the Crompton blk. on Front and Mechanic Sts., and will remodel it into a theater, the cost of the improvements to be about $250,000.

**Worcester, Mass.*—C. F. Hanson, Treas., Thule Music Hall Assoc., writes that the J. W. Bishop Co., 107 Foster St., will probably secure the contract for erecting the association building; probable cost, $65,000. Architect, Geo. H. Clemence, 405 Main St.

Grand Rapids, Mich.—Chas. O. Skinner, it is reported, has purchased a site and is interested in the erection of a furniture exposition building to be 6 stories high and erected at a cost of about $200,000.

**Lansing, Mich.*—Geo. Hagenmier, it is reported, has received the contract to erect a store on Washington Ave. for Cameron & Arbaugh, at $25,194.

Minneapolis, Minn.—The Electrical Eng. Co. will erect a 3-story brick store and warehouse at 21 W. 6th St., to cost $20,000.

Lowell A. Lamoreaux, Lumber Exchange, it is stated, has prepared plans for a warehouse which is to be erected at Lake St. and 4th Ave. S. for the Boyd Transfer & Storage Co. at a cost of $75,000.

St. Paul, Minn.—A 3-story brick factory is to be erected at Pine and E. 9th Sts. at a cost of $20,000. F. T. Whitney, owner.

The local council of Knights of Columbus, it is reported, is considering the erection of a building, to cost $30,000, and have appointed a committee to have charge of the matter, T. D. O'Brien being a member.

**Meridian, Miss.*—Archt. Frank P. Milburn, of Columbia, S. C., writes that Chas. A. Moses, of Chicago, Ill., has secured the contract for erecting a union depot for the Meridian Terminal Co. (bids opened at New Orleans, La., on Mar. 22) for $87,000. The same contractor also secured the contract at the same time for a building for the Southern Express Co.

St. Louis, Mo.—Plans have been prepared by J. L. Wees, 520 Olive St., for the 4-story building to be erected at 11th and Locust Sts., by Thos. Dunn, at a cost of about $100,000.

St. Louis, Mo.—The residents of Cabanne, it is stated, are about to form the Cabanne Union Realty Club Co. for the purpose of erecting a 2-story and attic building at Vernon and Union Aves. to cost about $40,000.

Joplin, Mo.—The Eagles are said to be contemplating the election of a club house and lodge rooms, to cost about $60,000.

Bayonne, N. J.—Hyman Rosensohn, 188 Market St., Newark, is said to be preparing plans for a 4-story brick store and flat building which is to be erected by Marcus G. Goodman, of 431 Ave. C, at 23d St. and Ave. C.

New York, N. Y.—It is reported that the officials of the N. Y. Central & Hudson River R. R. Co. (H. Fernstrom, Ch Engr.), will erect a temporary station at a cost of $200,000 for use during the construction of the new station on the old site.

**Maybrook, N. Y.*—O'Hehir, Brooks & Co., of Warwick, it is reported, have received the contract to erect an office building here for the N. Y., N. H. & Hartford R. R., at an approximate cost of $15,000.

**Items marked thus give the names of parties awarded contracts.*

Brooklyn, N. Y.—Abel Cook, 93 Nassau St., N. Y. City, is Chm. of the Executive Com., having in charge the matter of erecting a Masonic Temple at Lafayette and Clermont Aves., at a cost of $300,000.

Oneida, N. Y.—The Odd Fellows are said to be contemplating the erection of a temple at a cost of $19,000.

**Rochester, N. Y.*—Plans have been filed for an office and factory building which is to be erected by the Eastman Kodak Co. on State St., at a cost of $107,131. Chas. F. Crandall & John F. Strobel, E. & B. Bldg., are the archts.; A. Friederich & Sons Co., of Rochester, are the builders.

Buffalo, N. Y.—It is stated that bids will be received Apr. 30 by S. H. Woodruff, Archt., 908 Mutual Life Bldg., for erecting a brick bank building for the People's Bank.

Grand Forks, N. D.—It is reported that the Great Northern Ry. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.), is about to spend $200,000 in improvements which will include a depot, roundhouse, etc.

Springfield, O.—It is reported that plans have been completed for a depot which is to be erected here by the Big Four R. R. (G. W. Kittredge, Ch. Engr., Cincinnati), at a cost of about $200,000.

Ashtabula, O.—It is reported that the round house of the Pennsylvania R. R. (W. R. Brown, Ch. Engr., Philadelphia, Pa.) has been destroyed by fire and is to be rebuilt at once.

Cincinnati, O.—It is reported that M. D. Woodford has applied for a permit to erect a 7-story concrete building at Walnut St. and Lippincott alley to cost $60,000.

East Liverpool, O.—Smith Fawler, it is stated, is interested in the erection of a 6-story brick, steel and concrete fireproof business building. W. A. Calhoun, Archt., of East Liverpool, may be able to give further information.

Pittsburg, Pa.—A 14-story office building is to be erected at 412 Grant St. by the Commonwealth Realty Co. Edw. J. Schellentracer, Empire Bldg., is the archt.

*Golden & Crick, 3512 5th Ave., it is stated, Ave. and 6th St. for the Hotel Annex Co. The total cost of the building is to be about $450,000.

Allegheny, Pa.—The Council has passed an ordinance granting to the Pittsburg, Ft. Wayne & Chicago R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia), a site on Church Ave. and Federal St. on which to erect a station. Plans have brick and terra cotta fireproof hotel on Penn have received the contract to erect a 12-story been approved by the company for a brick and stone structure to cost about $250,000.

Shenandoah, Pa.—Bids will be received by C. Schmidt, Mgr. Home Brewing Co., Shenandoah, on Apr. 12 for the erection of a 4-story brick hotel, as advertised in The Engineering Record.

**Titusville, Pa.*—The Ajax Constr. Co., of Pittsburg, it is reported, has received the contract to erect a 7-story steel frame building at Sycamore and Centre Sts. to cost $66,890. Fred. N. Chambers, of Oil City, Pa., is the archt.

**Philadelphia, Pa.*—John R. Wiggins & Co., Heed Bldg., have secured a permit to erect a 6-story building at 13th and Sansom Sts. for J. A. Bayard Kane. Cost $30,000.

Local press reports state that bids are to be received until Apr. 10 by Ballinger & Perrot, Archts., 102 S. 12th St., for erecting a warehouse for the Crane Co. at American and Master Sts.

Dallas, Tex.—It is reported that the Parlin & Orendorff Co., of Canton, Ill., mfgr. of haying machinery, (U. G. Orendorff, Secy.) is contemplating the erection of 2 warehouses in this city at a total cost of $100,000.

**Houston, Tex.*—H. R. Alsop, of Houston, it is reported, has received the contract to erect a hotel at Jackson and College Sts. at $12,000.

Beaumont, Tex.—Bids will be received until Apr. 5 by the E. L. Wilson Hardware Co., for the erection of one and two-story buildings of brick or cement blocks, according to plans prepared by John A. Etler, of Beaumont.

Montpelier, Vt.—The Comrs. of Green Mountain Cemetery, it is reported, have decided to erect a chapel and receiving vault to cost $32,000.

Walla Walla, Wash.—Henry Osterman, of Walla Walla, it is reported, is to prepare plans for a temple which is to be erected for Masons of the city, the cost to be about $32,000.

Seattle, Wash.—A building permit has been granted to the Seattle Electric Co. to erect a 1-story brick car barn to cost $25,000.

Tacoma, Wash.—Stone, Fisher & Lane, it is reported, will erect a department store on S. 11th and C Sts., at a cost of about $60,000.

Milwaukee, Wis.—C. F. Ringer, 106 Mason St., it is reported, is preparing plans for a 5-story building which is to be erected at 5th and Clybourn Sts., at a probable cost of $125,000.

Madison, Wis.—The Chicago, Milwaukee & St. Paul Ry. (D. J. Whittemore, Ch. Engr., Chicago, Ill.), it is reported, is contemplating the erection of a depot here, to cost about $25,000.

**Victoria, B. C.*—A. E. Barrett, of Seattle, Wash., it is reported, has received the contract to erect the Canadian Pacific Ry. hotel in this city, the cost to be about $500,000.

Chapala, Mex.—Geo. E. King, of Guadalajara, it is reported, has prepared plans for a hotel which the Lake Chapala Agricultural & Improv. Co. (Dwight Furness, Pres., Guanajuato) contemplates erecting at Ribera Castellanos on Lake Chapala.

Peterborough, Ont.—Bids will be received until Apr. 8 by the Secy. Peterborough Lock Mfg. Co., for erecting buildings. J. E. Belcher, Archt., Peterborough.

Montreal, Que.—A building permit has been granted to D. Hatton to erect a 4-story store and factory building at Gosford and Craig Sts., to cost $15,000.

NEW YORK, N. Y.

110 E 23d St, 10-story br and stone office and storage bldg; c, $70,000; o, Oswald Oelschlaeger, a, Geo M Walgrove.

126 W 42d St, 6-story br and stone store and loft bldg; c, $100,000; o, C C Shayne; a, Albert S Gottlieb.

104 E 38th St, 7-story br and stone loft bldg; c, $45,000; o, J W Stern & Co; a, Wm C Sommerfeld.

362 W 52d St, 6-story br and stone store and tenemt; c, $40,000; o, Benj Berger; a, Geo F Pelham.

56th St and Lexington Ave, 3-story br and stone stable; c, $40,000; o, David H Taylor; a, Chas A Gifford.

99th St and 2d Ave, 2 6-story br and stone stores and tenemts; total c, $70,000; o, Sugarman & Adelstein; a, Horenburger & Straub.

133 E 109th St, 6-story br and stone store and tenemt; c, $35,000; o, Ike Cohen; a, Horenburger & Straub.

311 E 109th St, 6-story br and stone store and tenemt; c, $45,000; o, Co-operative Society; a, Geo F Pelham.

121 E 113th St, 6-story br and stone store and tenemt; c, $40,000; o, Jos Ravitch; a, Horenburger & Straub.

109 E 124th St, 5-story br and stone store and loft bldg; c, $20,000; o, Jas M Horton; a, E E Campbell.

1st Ave and 69th St, 3 6-story br and stone stores and tenemts; c, $114,000; o, Hamberger-Kleinfelt & Rothfield Realty Co; a, Edward A Meyers.

3d Ave and 161st St, 6-story br stores and tenemts; c, $50,000; o, Jas A Rennie and John Allen; a, Harry T Howell.

Beekman and Cliff Sts, alterations to 6-story br and stone office bldg; c, $20,000; o, Zinsser Realty Co; a, Carrerre & Hastings.

Belmont Ave and Oakland Pl, 2 5-story br stores and tenemts; total c, $65,000; o, Chas Ast; a, Horenburger & Straub.

Courtland Ave and 154th St, 5-story br stores and tenemts; c, $60,000; o, Henry S Gomp; a, Geo F Pelham.

*The following are the bids opened on Mar. 27 by C. B. J. Snyder, Supt. School Bldgs., for installing, ventilating and heating apparatus for addition to and alterations in School No. 83, Manhattan Boro.: Rossman & Bracken Co., $20,725; Harry L. Philip, $20,217; E. Rutzler Co., 178 Centre St., $19,595 (awarded contract); Geo. A. Suter, $19,949; Walker & Chambers, $20,989, and Ralph J. F. Gerstle Co., $23,323.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Santa Ana, Cal.—It is reported that the congregation of the First Presbyterian Church has decided to erect a new edifice, at a cost of $15,000. Rev. H. C. Shoemaker, pastor.

Boulder, Colo.—The erection of a new edifice for the Congregational Church is under consideration. Probable cost, $25,000.

Hartford, Conn.—The congregation of the First Universalist Church, it is reported, has decided to erect a new edifice, the cost, including furnishing, not to exceed $50,000.

Salem, Ill.—It is reported that the congregation of the M. E. Church is contemplating the erection of a new edifice at a cost of $25,000. H. S. Shrigley, Treas.

Cairo, Ill.—Kelly & Kusner, 1916 Commercial Ave., it is reported, have prepared plans for a convent to be erected by the St. Joseph R. C. Church at a cost of $15,000. Rev. J. B. Diepenbrook, pastor.

Chicago, Ill.—The Sisters of Loretto will build a novitiate in Hyde Park after plans by J. F. & J. P. Doerr, 138 Washington St. The building will be a 3-story structure, 58x140 ft., and will be erected at Washington Park and Jackson Terrace. Estimated cost, $80,000.

The Woodlawn M. E. congregation has decided to build a new church at 64th St. and Woodlawn Ave. The cost will be about $50,000.

Muncie, Ind.—Plans are being prepared for an apartment house which is to be erected at Washington and High Sts. at a cost of $20,000, by A. G. Arrasmith.

Annapolis, Md.—R. N. McCulloh & Co., of Baltimore, it is reported, have submitted the lowest bid for erecting an edifice for the College Ave. Baptist Church, the estimated cost of which is $25,000.

Owosso, Mich.—W. G. & F. S. Robinson is preparing plans for a 3-story brick, terra cotta and stone apartment house which is to be erected at Jefferson Ave. and Fulton Sts. by Morton H. Luce at a cost of $20,000.

Minneapolis, Minn.—E. Stebbins, Masonic Temple, is stated to have prepared plans for an edifice for the Holy Rosary R. C. Church, to be erected at 1719 E. 24th St., to cost $25,000.

St. Joseph, Mo.—It is stated that the erection of a school in South St. Joseph, to cost about $12,000, is under consideration.

Bayonne, N. J.—Chas. Edw. Patterson, it is stated, is preparing plans for a new edifice which the congregation of the St. Vincent de Paul R. C. Church will erect on Ave. C and 47th St. It is to be a stone structure 80x100 ft. and is to cost about $35,000. Rev. P. A. M. McCormick, 20 W. 51st St., pastor.

Long Island City, L. I., N. Y.—Plans have been approved for a R. C. Church to be erected at Broadway and McCormick St. for Rev. Father La Cain; cost $20,000.

Winston-Salem, N. C.—The erection of a granite edifice to cost $25,000 is contemplated by the congregation of the St. Paul's Episcopal Church.

Zanesville, O.—Geo. D. Griffin, of Fairmont, W. Va., it is stated, has prepared plans for a new edifice which the Market St. Baptist Church contemplates erecting, at a cost of $35,000.

Cincinnati, O.—Otto Armleader, it is stated, is contemplating the erection of a $20,000 flat.

A new edifice is to be erected for the congregation of Brotherly Love in W. Walnut Hills, at a cost of about $50,000.

Jos. G. Steinkamp & Bro., Mercantile Library Bldg., it is stated, are preparing plans for a 3-story apartment house to be erected at 8th St. and Purcell Ave. for Mrs. D. W. Bellville at a cost of $20,000.

Cincinnati, O.—W. W. Franklin, 5th and Race Sts., it is stated, is preparing plans for a flat to be erected at Michigan and Erie Sts., at a cost of $25,000.

**Pittsburg, Pa.*—Golden & Crick, 3512 5th Ave., it is stated, have received the contract to erect a $30,000 brick residence for Judge Jas. R. Macfarlane on Woodland Road.

Sumter, S. C.—The Bldg. Com. of the Presbyterian Church has authorized plans prepared for a new edifice to cost about $15,000.

Ft. Worth, Tex.—The congregation of the Broadway Baptist Church, it is reported, intend erecting a new edifice at Leuda St. and College Ave. to cost $25,000.

Spokane, Wash.—The congregation of the First Baptist Church, it is reported, is contemplating the enlarging of its edifice, at a cost of $40,000.

Lake Geneva, Wis.—Shepley, Rutan & Coolidge, of Chicago, Ill., it is reported have been engaged to prepare plans for a residence which is to be erected here for N. W. Harris and is estimated to cost $100,000.

Milwaukee, Wis.—Buemming & Dick, 1107 Pabst Bldg., it is reported, have prepared plans for a brick and stone edifice, which is to be erected by the congregation of St. Matthew Church at a cost of $20,000. Rev. F. C. Ryan, Pastor.

A building permit has been granted to the congregation of St. Laurentius Church to erect a new edifice at 22d Ave. and Orchard St., at a cost of $60,000. E. Brielmaier & Sons, 111 Mason St., are the Archts.

Winnipeg, Man.—Oldfield & Gradner, it is stated, are having plans prepared for a 5-story apartment house which is to be erected at Broadway and Edmonton St.

NEW YORK, N. Y.

13 W 85th St, 15 4-story br and stone dwells; total c, $450,000; o, Jas Carlew Constr Co; a, L A Goldstone.

309 W 92d St, 4-story br and stone dwell; c, $20,000; o, C T Root; a, Chas A Rich.

133d St and 7th Ave, 6-story br and stone tenemt; c, $40,000; o, Saml Mandel; a, Rouse & Sloan.

179th St and Amsterdam Ave, 3 5-story br and stone tenemts; c, $150,000; o, Hyman H Ellenger; a, Lorenz F J Weiher.

Washington Ave and 169th St, 2 5-story br tenemts; total c, $80,000; o, Jacob Bloom and Julius Levy; a, Horenburger & Straub.

Wendover and 3d Aves, 2 5-story br stores and tenemts; total c, $80,000; o, Isaac Leader and Jacob Bloom; a, Horenburger & Straub.

SCHOOLS.

Notes Arranged Alphabetically by States.

Boulder, Colo.—The School Bd. has accepted plans for a school to be erected southwest of the Univ. at a cost of $22,000.

Bridgeport, Conn.—Bids will be received until Apr. 10 by the Bd. of Educ. for erecting an 8-room school at Newfield Ave. and Smith St. C. T. Beardsley, Jr., Archt., Rm. 22, Bridgeport Savings Bank Bldg.

Washington, D. C.—The following are the bids opened on Mar. 25 for erecting the Henry T. Blow School: (*a*) limestone trimmings, (*b*) manufactured stone trimmings: J. M. Dunn, *a* $44,568, *b* $43,368; J. S. Reynolds, *a* $43,995, *b* $43,613; J. H. Gibbons, *a* $43,430, *b* $43,000; Burgess & Parsons, *a* $42,693, *b* $42,193; Gleeson & Humphrey, *a* $42,895, *b* $42,600.

Broxton, Ga.—The citizens have voted in favor of issuing $10,000 school bonds.

Corydon, Ia.—J. M. Stromston, City Secy., writes that it was voted Mar. 13 to issue bonds for a high school; probable cost from $12,000 to $15,000.

Des Moines, Ia.—The School Bd. it is stated, is about to sell $25,000 school bonds, and is considering the selection of a site at 16th and Jefferson Sts., on which to erect the new school for North Des Moines.

Aurora, Ill.—The Bd. of Educ. has accepted the plans of Lewis & Kitchen, of Chicago, for the ventilating and heating of the proposed new high school, the cost being approximately $5900.

**Galesburg, Ill.*—Peter T. Olson, 1020 Bateman St., it is stated, has received the contract for erecting the power and heating plant for the 3 schools on Broad St., at $8,563, and Lewis & Kitchen, of Chicago, the contract for equipment at $11,676.

**Vincennes, Ind.*—Howard Bros., Ill., it is stated, have received the erect an 8-room school here, at $29

Muncie, Ind.—Grindle & Byrne, berry St., it is reported, have been prepare plans for a $40,000 school.

Winchester, Ky.—The Bd. of E Kentucky Wesleyan College (Dr. W of Nicholasville, Pres.) is taking a cating and rebuilding the college w stroyed by fire recently, and have $ able for the work.

**Gas, Kan.*—J. M. Anderson, of is stated, has received the contract school here, at $17,715.

Baton Rouge, La.—The followin reported to have been received by Com. on Mar. 23 for erecting a s Joseph, S. Boule., Asia and Maxi Alexander Farmer, Baton Rouge, D. Stewart, Baton Rouge, $28,900; dahl & Co., Memphis, Tenn., $30,9 Morrow Constr. Co., Louisville, K All bids have been rejected, as th the estimate, which was $25,000, an are to be drawn.

Cheneyville, La.—The School Au about to sell $20,000 bonds with w a brick school.

**Springfield, Mass.*—W. A. Ford, Property Com., writes that the plumbing in the Technical High opened Mar. 22) has been awarde Hyland, of Springfield, for $9,898.

Separate bids will be received A City Property Com. (W. A. Ford, installing in new Technical High S zontal tubular boilers of 125-h.p. tilating and heating plant; also fur ors for ventilating and heating pl Almirall & Co., Engrs., 281-3 Wate City.

**Boston, Mass.*—Angus McDonald ant St., has secured the contract fo 3-story, 24-room primary school on Lewis Dist., Roxbury (bids opene for $158,820.

Palmer, Mass.—John F. Foley, writes that the citizens have voted addition to the high school, to cost

Plymouth, Mass.—The citizens to have voted Mar. 25 to erect a cost of $25,000.

**Saginaw, Mich.*—Harrison & R Saginaw, it is reported, have recei tract to rebuild the Houghton Schoo This does not include heating and

Pontiac, Mich.—The citizens of School Dist., it is stated, have vot of issuing $25,000 bonds to erect W. Huron St.

Ann Arbor, Mich.—Bids will be r 10 by the Regents of the Univ. (Jas. H. Wade, Secy.), for erecting to the Physical Laboratory. Probabl 000. Pond & Pond, Archts., Chic

South St. Paul, Minn.—The Sc is stated, is receiving plans for a it is proposed erecting at a cost of

Minneapolis, Minn.—It is reporte ence H. Johnston, Manhattan Bldg has prepared plans for the main bu is to be erected at the Univ. of M a probable cost of $50,000.

It is stated that the Univ. of Min a new medical building, to cost ab It is to be 4 stories high, and is t on the campus back of the State B Bldg.

**St. Paul, Minn.*—H. J. Frands ported, has received the contract t room addition to Whittier School at

Kansas City, Mo.—The Spalding College will erect a school on 10 Sts., to cost $25,000.

Dillon, Mont.—The Bd. Trus. o Normal College is stated to have plans of C. S. Haire, of Helena, fo dition to cost $60,000.

Reno, Nev.—It is stated that bid ceived by the Regents until Apr. structing a brick and stone building vada State Univ. Geo. H. Taylor,

Hanover, N. H.—The erection of ing for the Medical School at Da lege, to cost about $30,000, is rep consideration.

Kearny, N. J.—Jos. B. Kennedy, has prepared plans for a parochial erected for St. Cecilia R. C. Chur to be of brick and steel, 3 stories hi about $50,000.

Newark, N. J.—See "Water."

Harrison, N. J.—Bids will be r 17, by the Bd. of Educ. (Jas. J. Ke for erecting Cross St. school, inclu tilating and heating system.

Camden, N. J.—Thos. Stephen, Camden, it is reported, will soon for erecting a parochial school for of Sts. Peter and Paul at St. John Sts. The building is to be of sto high, 40x137 ft., and to cost about

Perth Amboy, N. J.—The Bd. considering plans submitted by Jo ton and J. K. Jenson, both of P for a 6-room addition which it is pr ing to school No. 1. The cost is the archts. at $22,000 and $24,381

Paterson, N. J.—The Bldg. Cm. o Educ. is considering the plans su school No. 21 as prepared by Sa which provide for a 2-story buildin by W. T. Fanning, 138 Jersey St., vide for a 3-story structure.

**Items marked thus give the names of parties awarded contracts.*

N. J.—The Central School Bldg. Com. of Educ., it is reported, has been au- accept the plans prepared by Herbert of N. Y. City, for the school which it d erecting at Main and Cleveland Sts. greements can be reached as to alter- as to bring the cost of the structure appropriation which is $70,000.

od, N. J.—The erection of a $75,000 Engle St. is reported to be under con-

rk, N. Y.—Plans have been filed for brick and stone school to be erected t. and 6th Ave. at a cost of $75,000, brick and stone school to be erected and Mangin Sts. at a cost of $28,000, ity of New York. Archt., C. B. J. 0 Park Ave.; also for a 4-story brick parochial school to be erected at n and Barrow Sts. at a cost of $90,000 . Veronica's Church Corporation. Wm. ct, Archt., 11 E. 42d St. ll be received Apr. 10 by C. B. J. upt. School Bldgs., for sanitary work tting in School No. 64, Boro. Man-

l be received until Apr. 24 by the Com. of the Bd. of Trus. of the College of f New York (Chas. Putzel, Secy.) for contract for mason, iron, marble, etc., elevator, electric and other work for ngs of said College, located on St. Terrace and 140th St.

Brighton, S. I., N. Y.—The following ids opened on Mar. 27 by C. B. J. Supt. School Bldgs., N. Y. City, for nstruction of School No. 33, Boro. of : W. H. C. Russell, $19,875; Wm. 21,972; U. W. Osborn, $18,895; Louis $19,885; Daniel J. Ryan, $18,342; schler, $19,678, and Thos. Cummings, 43 (awarded contract).

yn, N. Y.—The following are the bids Mar. 27 by C. B. J. Snyder, Supt. dgs., N. Y. City, for general construc- of School No. 6, Boro. of Brooklyn: ebrand, $269,700; John Auer & Sons, Juan P. Arci, $279,000; Daniel J. 4,000; F. W. Carlin Constr. Co., $284,- ard E. Henigham, $278,700; Clarke 15th Ave. and 71st St., $253,700 contract); John Thatcher & Son, $257,- . Walsh, $273,000; Thos. Cockerill & ,500; P. J. Brennan, $262,000.

L. I., N. Y.—Bids will be received by Snyder, Supt. School Bldgs., N. Y. . 10, for addition to and alterations in o. 17, Corona, Boro. Queens. Separate be received for installing ventilating ng apparatus for said addition.

, L. I., N. Y.—Bids will be received J. Snyder, Supt. School Bldgs., N. Y. . 10, for addition to and alterations No. 49, Jamaica, Boro. Queens. Sep- s will be received for installing ven- d heating apparatus for said addition.

, N. Y.—The Common Council, it is s adopted a resolution authorizing the Pub. Wks. to prepare plans and speci- and to receive bids for erecting a 16- ool in Dist. No. 29 and also a 16-room Moselle and Urban Sts.

N. Y.—Bids will be received Apr. 15 v. Rector of Holy Angels' Church, 348 e., for erecting a school on West Ave.

N. Y.—Bids will be received until by the Dept. Pub. Wks. (Francis G. omr.), for erecting iron stairways for f fire-escapes on several school build- uding the Central High School.

City, N. D.—It is reported that bids d Apr. 8 for erecting a school. Sep- s will be received for erecting building, heating plant and plumbing. Geo. A. d, Secy. School Bd.

ville, O.—S. B. Piper, of the Bd. of is stated, has announced that the erec- schools to cost about $35,000 is under letion.

k, O.—D. M. Keller, Clk. Bd. Educ., at the contract for erecting a 12-room the Woodside addition (bids opened has been awarded to W. W. & E. E. Lancaster, O., for $38,845. Fitzpatrick er, of Columbus, secured the contract lating and heating same, for $5,194.

O.—L. G. Welker, "The Spitzer," it has been engaged by the Bldg. Com. d. of Educ. to prepare plans for an ddition to the Hoag School, to cost ,000.

town, O.—Bids will be received Apr. Rev. M. P. Kinkead, 811 Oak St., for material and constructing a school Immaculate Conception parish.

eny, Pa.—S. H. McCain, of Pitts- s reported, has received the contract to 3-story brick and stone manual train- l on Irwin Ave. at about $75,000. F. , Archt., 804 Penn Ave., Pittsburg.

burg, Pa.—It is reported that school ounting to $85,000 have been sold.

ead, Pa.—The West Homestead d. has purchased a site on Doyle Ave. it is proposed to erect a school at a 20,000.

liver, Pa.—Ernst & Hanselmann, of , are preparing plans for an addition ations in the St. Joseph R. C. parochial cost about $80,000.

delphia, Pa.—The Wells Bros. Co., of ty, it is reported, has received the con- erecting the first building of the Car- hnical Schools (bids for which were re- Mar. 21), at $499,700. E. F. Fonder & Co., Land Title Bldg., ted, has received the contract to erect ol at 32d and Berks St. (bids opened Mar. 28), at about $84,000. Other bids received, it is reported, were as follows: Chas. Gilpin, $86,000; Thos. Reilly, $86,283; Metzger & Wells, $86,900; Lynch Bros., $86,998; Melody & Keating, $88,125; Henderson & Co., $89,627; W. Christy & Son, $89,648; David Peoples, $89,897; John R. Wiggins & Co., $90,500.

West Chester, Pa.—Seymour & Paul A. Davis, of Philadelphia, it is stated, have been engaged to prepare plans for the proposed $100,000 high school. It is to be of brick with stone trimmings, 140x110 ft.

**Conway, S. C.*—E. H. Leslie, of Bishopville, it is reported, has received the contract to erect a 2-story brick school at $10,000.

Castlewood, S. D.—The Bd. of Educ. is contemplating the erection of a new school to cost about $15,000.

El Paso, Tex.—The citizens on Mar. 18 voted in favor of issuing $50,000 bonds to erect a new school and an addition to the high school.

Houston, Tex.—Bids will be received until Apr. 10 by R. N. Little, Secy. School Bd., for erecting a 12-room brick school on the Cobb-Brackenridge property. L. S. Green, Archt., Commercial Bank Bldg.

Port Arthur, Tex.—A. M. Rutan, Secy. Bd. School Trus., writes that the plans of F. C. Wagner & Co., 423 Temple Court Bldg., Denver, Colo., have been accepted for a high and manual training school combined. Contract for construction will probably be let about May 15.

Grafton, W. Va.—Jas W. Holt, Pres. Bd. Educ. writes that it was voted Mar. 21 to issue $25,000 bonds for school improvements.

McMechen, W. Va.—Bids will be received until Apr. 26 by the Bd. Educ. of the Dist. of Union, for erecting a 15-room school on stone and concrete foundation here. Separate bids will be received at the same time for 25,000 sq. ft. metal ceilings. C. L. Evans, Secy., Benwood.

Petersburg, W. Va.—Local press reports state that bids will be received Apr. 14 by the Bd. of Educ. for erecting the superstructure of the McKinley School.

Chippewa Falls, Wis.—It is reported that the Bd. Pub. Wks. has decided to reject all bids recently received for erecting a school on the south side, and to have new plans prepared so as to keep the cost within the appropriation, which is $15,000.

Waukesha, Wis.—Leenhouts & Guthrie, 102 Wisconsin St., Milwaukee, it is reported, are preparing plans for a $25,000 brick school, to be erected here.

Madison, Wis.—The erection of a hydraulic laboratory and a new foundry at the Univ. of Wisconsin, at a total cost of $25,000, is reported under consideration.

New Richmond, Wis.—The erection of a new high school, at a cost of $50,000, is reported under consideration.

La Crosse, Wis.—The City Council is considering the erection of a high school, at a cost of $100,000.

Auburn, Wis.—It is reported that the School Bd. has decided to erect a $15,000 school in Dist. No. 61.

Galesville, Wis.—It is reported that the Trus. of Gale College have decided to erect a dormitory here to cost about $15,000.

Wauwatosa, Wis.—Wm. R. Nethercut, Chmn. Bd. of Educ., writes that all bids opened on Mar. 20 for erecting the high school have been rejected, and new bids will be received on Apr. 10.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—H. J. Lelande, City Clk., writes that the only bid received on Mar. 15 for the construction of a garbage crematory was that of the Decarie Mfg. Co., of Minneapolis, Minn. New bids will be received on Apr. 24. According to press reports, the bid of the Decarie Co. was $70,864.

Topeka, Kan.—City Engr. McCabe is stated to have completed a report on the construction of a garbage crematory and estimate the cost at about $15,000. The citizens will probably vote on question Apr. 4.

Holyoke, Mass.—Press reports state that bids will be received Apr. 7 by the Bd. of Pub. Wks., for collecting the city garbage, for term of 1, 2 or 3 years.

Asbury Park, N. J.—Bids will be received Apr. 3 by the Common Council for the removal of garbage, rubbish, ashes, etc. Chas. A. Atkins, Chmn., Street Com.

**Cleveland, O.*—The Bd. of Pub. Service is stated to have on Mar. 24 awarded to the Edson Reduction Co. the contract for enlarging the municipal plant and the installing of new machinery for $65,000.

Avalon, Pa.—Bids will be received by Elmer E. Custard, Boro. Clk., 416 Forest Ave., Apr. 4, for the removal and disposal of garbage.

South Bethlehem, Pa.—Bids are wanted Apr. 3 for the collection, removal and disposal of garbage, for a term of 2 years. Thos Ganey, Boro. Secy.

Knoxville, Pa.—Bids will be received Apr. 3 by the Street Com. (A. Belsmeyer, Chmn.) for removing garbage for a term of 1 year.

Chester, Pa.—It is stated that bids will be received until Apr. 3 by M. S. Hatton, Chmn. St. Com., for the removal and disposal of garbage during the fiscal year 1905.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

According to Chas. B. Gordon, Dryden, Ont., the Dryden Board Mills, Ltd., propose erecting a mill with a daily capacity of 30 tons of finished board. The equipment will consist of a 120-in. board machine, a 20-ton sulphite mill and and a 20-ton ground wood pulp mill. The power house and ground-wood room will be 98x70 ft., and will contain four pairs of water wheels, each pair developing 350 h.p., one pair developing 300 h.p., and single wheels developing 180, 140, 120, 100 and 60 h.p., respectively. There will be a 294x40-ft. board room with an 84x40-ft. finishing room at the end; a 95x45-ft. sulphite mill, containing two 11x35-ft. digesters and other necessary equipment for a 20-ton mill, and a 45x50-ft. boiler house, which will contain two 400-h.p. boilers.

The Consolidated Car-Heating Co., 42 Broadway, New York, is building a 4-story, 46x100-ft. brick addition to its factory at Albany, N. Y. A power plant of about 75 h.p. capacity will be installed.

The Wm. Tinkham Co., Harrisville, R. I., will erect a 2-story, 176x50-ft. yarn mill. An electric power plant of 125 h.p. capacity will be installed.

J. R. Keim & Co., 515-517 Market St., Philadelphia, Pa., have let contract for an addition to their wooden mill to Roydhouse, Arey & Co., of Philadelphia.

J. E. Smith & Co., Waterbury, Conn., write that they will erect a 3-story and basement mill and warehouse, to be about 53x125 ft. The question of power has not yet been decided, but it will probably be electric of about 50 h.p. capacity.

The Taylor Bros. Co., Rochester, N. Y., which makes thermometers, etc., has let contract for a new factory building to contain 60,000 sq. ft. floor space. The power plant will be of 100 h.p. capacity.

The American Pulley Co., 29th and Bristol Sts., Philadelphia, Pa., is adding a 140x50-ft. bay to its buildings, and proposes to install boilers of 350 h.p. capacity.

Dodge & Day, engineers, Philadelphia, Pa., who were commissioned sometime since by the Lehigh Coal & Navigation Co. to take charge of extensive shop improvements at Lansford, Pa., including new bupildings, machine tools and electrical equipment—in fact, all details in connection with such a layout—have been further commissioned to take charge of the erection of a new centrally located power plant. This plant will provide current for the shops, Tamaqua & Lansford street railway, and electrical equipment which will be installed in the mines for pumping and transportation purposes. Dodge & Day are now investigating the latter subject, and specifications will shortly be sent out by them. Mr. Herbert Clarke, engineer for the Tamaqua & Lansford street railway, will cooperate with them.

The Lackawanna Valveless Motor Co., 1268 West Ave., Buffalo, N. Y., intends to erect a new factory, but at present cannot give details regarding it.

The Louisa, Ky., Canning Co. will erect a 32x99-ft. building and install a 40-h.p. boiler and a 25-h.p. engine.

The Dawson, Tex., Cotton Oil Co. is in the market for a 50 to 60-ft steel tower, 10,000 to 15,000-gal. steel or cypress tank, 6 and 4-in. black pipe and a 500-gal. fire pump.

The San Francisco Brick Co., Wells-Fargo Bldg., San Francisco, Cal., will at once rebuild its plant, which was recently burned. The capacity of the power plant is about 400 h.p.

The Morgan Silver Plate Co., Winsted, Conn., contemplates erecting a 3-story, 30x50-ft. addition of mill construction to its plant, and will install a 50-h.p. boiler to furnish steam for the plating department and for heating.

For repair shops at Greenville, Pa., see "Railroads."

The Kaolin Putty Co., Louisville, Ky., incorporated with a capital of $200,000, will, according to local press reports, erect factories in Louisville and Macon, Ga. J. P. Venable, president of the local painters' association, and W. F. Gregory, both of Louisville, are stated to be among the incorporators.

B. Frank Mebane and Arthur Draper, of Charlotte, N. C., will, according to local press reports, build a $1,000,000 denim mill at Spray, N. C.

S. H. Bolinger & Co., Bolinger, La., whose sawmill was recently burned, will rebuild as soon as possible. The size of the building will be 36x130 ft., and contract has been let to the Prescott Co.

The Grand Crossing, Ill., Track Co., whose plant was recently burned, is not yet ready to give out a statement of the details concerning the rebuilding of the plant, as matters are still in the hands of insurance adjusters.

The Texas Iron & Steel Co., according to W. S. Patterson, Detroit, Mich., plans to locate its plant near Houston, Tex., but no details are available before the company's April meeting.

E. A. Saunders, Jr., Richmond, Va., has, according to local press reports bought a lot 380x240 ft. in size, and will erect a cigar factory to cover the lot. It is stated that the investment will represent $100,000.

The Trumbull Elecric Co., Plainville, Conn., will erect a brick shop, plans for which are nearly completed. Inquire of Wm. H. Cadwell, New Britain, Conn.

The Johannigman Foundry Co., Cincinnati, O., has, according to local press reports, bought ground on which to erect a 2-story, 60x100-ft building of brick and steel construction, to cost $35,000. Martin Fisher, archt.

For paper mill at Rothschild, Wis., see Milwaukee, under "Electric Railways."

H. J. Elson, 402 N. 4th St., St. Louis, is in the market for new or second-hand cold saw, drill presses and punches for handling structural shapes.

Contract has been let to T. W. Linstead, according to local press reports, for a new factory for the Bristol Specialty Co., to be erected at Terryville, Conn.

The American Hardwood Co., Memphis, Tenn., which was recently organized, will, according to local press reports, erect a plant as soon as a site can be secured. Dr. E. A. Neely, pres.

The Spaulding Mfg. Co., Montezuma, Ia., will, according to local press reports, enlarge its plant by the erection of a 76x78-ft. blacksmith shop and a 3-story, 52x91-ft. building to be used for woodworking and trimming.

At a meeting of the directors of the Philadelphia & Reading Ry. Co., authority was given, according to press reports, to increase the capacity of the shops at Reading, Pa. It is stated that the directors authorized an appropriation of $500,000 to construct new shops and purchase additional machinery for the plant.

A permit was taken out to erect a 4-story, 65x185-ft. addition to the plant of Hirsch Bros. & Co., Louisville, Ky., to cost $25,000.

The Crescent Mfg. Co., Greenfield, O., has secured a permit to erect a 121x373-ft. brick building at 33d and Market Sts., Louisville, Ky., to cost $20,000.

The Camden, N. J., White Lead Co. has, according to local press reports, taken out permits to erect a 90x130-ft. building and a 19x30-ft. boiler-house. The buildings will be erected by Andrew Mowburg.

A correspondent writes that the Oliver Iron Mining Co., Ishpeming, Mich., will erect a machine shop, to cost $45,000. Electric power will be used. Wm. H. Johnston can be addressed regarding specifications, etc.

The Homestead Co., Des Moines, Ia., will, according to local press reports, erect a 4-story, 66x132-ft. publishing building, to cost $100,000.

The Kemp & Burpee Mfg. Co., Syracuse, N. Y., will, according to local press reports, establish a branch factory in Davenport, Ia.

Geo. W. Fredericks was granted a permit for a 3-story, 196x95-ft. packing house, to be erected at Third St. and Girard Ave., Philadelphia, for Louis Burk.

The Simplex Railway Appliance Co. of Canada, Ltd., St. Henri de Montreal, Can., writes that it is not yet in a position to give details regarding its proposed new power-house and shops.

The Iron Clad Mfg. Co., 204-206 Varet St., Brooklyn, N. Y., has done nothing definite concerning the rebuilding of its plant, which was recently burned. The company has, however, bought six lots adjoining its factory, and will at once erect a barrel factory.

The North American Storage Co., New Paynesville, Minn., will erect a cold-storage plant at Alexandria, Minn., but work will not be commenced until late in the summer.

The Walter Baker Co., manufacturer of chocolate, is building a new power plant at Dorchester, Mass., to supersede the present four separate power plants. From this new plant power will be distributed electrically to all parts of its works. The new equipment consists of high-pressure boilers from the special designs of Dean & Main; two 750-kw. alternating-current generators driven by vertical cross-compound condensing engines, and two 125-kw., direct-connected alternators driven by Watertown four-valve engines. Dean & Main have incorporated in this plant many special features, and it is their expectation that this will be one of the most complete, economical and up-to-date power stations ever installed.

The Niles-Bement-Pond Co. has announced the purchase of a large factory property at Nicetown, Philadelphia, formerly occupied by the Cresswell & Waters Co., for an addition to its Philadelphia plants. This property will be greatly improved, and equipped with modern facilities for use as a foundry for the Bement-Miles Works branch of the company at Twenty-first and Callowhill Sts., and also the Niles-Crane Works branch, at Meadow and Mifflin Sts. This increase of facilities is one of the many important developments that have been made by the Niles-Bement-Pond Co. recently, owing to the large increase of business and many large contracts which have been taken. The combined plants in Philadelphia, regardless of the three other large plants operated by the company at Hamilton, O.; Plainfield, N. P., and Hartford, Conn., will now employ about 2,000 men, making it one of the largest industrial plants of the country.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**San Francisco, Cal.*—Capt. Wm. W. Harts, Corps Engrs., U. S. A., writes that the contract for embankment near Daguerre Point, Yuba River, Cal. (bids opened Feb. 17) has been awarded to A. B. Munson, of Stockton, for $24,800.

Washington, D. C.—Bids will be received Apr. 11 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yards, Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C.; Norfolk, Va., and Pensacola, Fla., a quantity of corrugated sheet steel, sheet copper, steel plates, plain anl galvanized bar steel, pig iron, steam pump, copper pipe, etc. H. T. B. Harris, Paymaster-Gen.

Des Moines, Ia.—The supervisors of Polk and Story Counties are reported to be considering the construction of a drainage ditch between the two counties. (Des Moines C. H., Polk County.)

**Ft. Dodge, Ia.*—H. S. Holmes, Co. Aud., writes that the contract for constructing 2 joint drainage ditches requiring about 200,000 cu. yds. excav. (bids opened Mar. 22), has been awarded to Kepner & Smith, of Ft. Dodge, at 11¾ and 10¾ cts. per cu. yd.

New Orleans, La.—The following are the bids opened on Mar. 25 by the Bureau of Yards

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**Items marked thus give the names of parties awarded contracts.*

& Docks, Navy Dept., Washington, D. C., for constructing a crane wharf, Naval Station, New Orleans (each bid contained certain modifications): American Bridge Co., Chicago, Ill., $50,400; Penn Bridge Co., 312 Bond Bldg., Washington, D. C., $44,390; Milwaukee Bridge Co., 1400 34th St., Milwaukee, Wis., $43,400, and Snare & Triest Co., 39 Cortlandt St., New York, N. Y., $50,900.

No bids were received on Mar. 25 by the Dept. of Docks, Navy Dept., Washington, D. C., for the grading and filling at the Naval Station, New Orleans. Funds available for this work, $25,000.

Baltimore, Md.—Bids will be received Apr. 5 by the Bd. of Awards (E. Clay Timanus, Pres.) for dredging. N. H. Hutton, Harbor Engr.

Boston, Mass.—Bids will be received Apr. 3 by the Metropolitan Park Comn., 14 Beacon St., for grading, surfacing and other work at Revere Beach Parkway, from Main St. to Fellsway, Everett and Medford, requiring 4,200 cu. yds. earth grading, 3,550 lin. ft. of 8, 10, 12, 15 and 18-in. pipe drains, 13,800 sq. yds. broken stone surfacing, 3,400 sq. yds. walk surfacing, etc. Wm. B. De Las Casas, Chmn.; John E. Rablin, Engr.

Holyoke, Mass.—Press reports state that bids will be received by the Bd. of Pub. Wks. Apr. 27, for 5,000 tons of trap rock.

Ft. Strong, Mass.—Maj. John E. Baxter, Q. M., U. S. A., Boston, writes that the following are the bids opened on Mar. 27 for furnishing material and constructing a riprap embankment of granite rock along east shore of reservation, at this post: Ruggles & Perkins, Boston, $6,436; Smith & Robinson, New York, N. Y., $6,440; W. H. Ellis, Boston, $6,541; John Cashman, Quincey, $7,000; Cafelo & Ferguson, Boston, $8,444; Jos. J. Callahan, Atlantic, Mass., $8,475; Holmes Bros., Boston, $8,900, and Svea Constr. Co., Boston, $12,920.

Munising, Mich.—Press reports state that the Munising Paper Co. wil construct 2 docks here this summer at a cost of $75,000.

Holly Beach, N. J.—Geo. A. Bourgeois & Son, of Ocean City, are stated to have secured the contract for constructing the beach front boardwalk for about $25,000.

Newark, N. J.—The Bd. of Freeholders is reported to have sold $500,000 county park bonds.

Albany, N. Y.—Bids will be received by Otto Kelsey, State Compt., Apr. 20, for $2,000,000

New York, N. Y.—See "Railroads."

**New York, N. Y.*—The following are the bids opened on Mar. 27 by the Dept. of Docks & Ferries for all labor and material required for preparing for and building a lateral extension to Pier No. 32, East River, at foot of Pike Slip: Bernard Rolf, 39 Cortlandt St., $31,733; Aug. Walsh, 96 Water St., $32,447; R. P. & J. H. Staats Inc., 29 B'way, $29,900 (awarded contract); G. B. Spearm, 17 Battery Pl., $38,425, and Wm. H. Jenks, 129 Pearl St., $40,000.

Bids will be received Apr. 6 by the Bd. Park Comrs (John J. Pallas, Pres.) for furnishing and delivering coarse and fine North River gravel for drives and bridle paths in Central and Riverside Parks.

The Bd. of Estimate on Mar. 24 readopted the resolution appropriating $1,000,000 for sites for playgrounds in different sections of the city.

Coney Island, N. Y. Harbor.—Bids will be received until Apr. 17 by Lieut.-Col. W. L. Marshall, Corps Engrs., U. S. A., N. Y. City, for dredging in Coney Island Channel, N. Y. Harbor, as advertised in The Engineering Record.

Columbus, O.—Chas. H. Frank, Secy. Bd. Pub. Service, writes that all bids opened on Mar. 15 for 6,000 street signs have been rejected.

Cleveland, O.—Director Leslie, of the Board of Pub. Service, is reported to have plans for improvements in Garfield Park, to cost about $30,000. An upper and a lower lake will be constructed, and a number of other improvements will be carried out.

Waco, Tex.—The following are the bids opened on Mar. 25 by the Superv. Archt. Treas. Dept., Washington, D. C., for installation of an electric passenger elevator in U. S. Post Office at Waco: Marine Engine & Machine Co., New York, N. Y., $5,729, and Otis Elevator Co., New York, N. Y., $5,195.

Norfolk, Va.—See "Power Plants, Gas and Electricity."

Milwaukee, Wis.—See "Sewerage and Sewage Disposal."

**Brandon, Man.*—W. H. Shillinglaw, City Engr., writes that the following are the bids opened Mar. 1 for 7,000 bbls. Portland cement, (*a*) price given per 100 lbs. net f.o.b. Brandon, (*b*) brand: Hunter Smith Hardware Co., Brandon, *a* 76 cts. (awarded contract), *b* Hercules; E. H. Bisseth, Winnipeg, *a* .7886 cts., *b* Alpha; Johnson & Co., Brandon, *a* .7758 cts., *b* Alpha or Hercules; Brown & Mitchell, Brandon (2 bids), *a* .7758 cts., *b* Alpha, *a* .775 cts., *b* Samson; W. F. Lee, Winnipeg, Man., *a* 83 cts., *b* Alpha; Thos. Black, Winnipeg (2 bids), *a* .8143 cts., *b* National, *a* .7857 cts., *b* Atlas; Western Supply & Equipment Co., *a* .809 cts., *b* Vulcanite; R. W. Paterson, Winnipeg, *a* 83 cts, *b* Iron Clad; Dunn Bros. & Co., *a* 79 cts., *b* Phoenix; R. Purdon, Brandon, *a* .793 cts., *b* Sun; R. J. Mackay, Brandon, *a* 80 cts., *b* Atlas. ,

Guaymas, Mexico.—The National Asso. of Manufacturers informs us that a Commission of Engineers (Natividad Gonzalez, Mexico City, Chief) is preparing plans for harbor improvements at Guaymas; about $5.000,000 is to be expended by the government.

Toronto, Ont.—The Bd. of Control is reported to have approved the plan for a new freight shed to be erected on the east side of Bay St. dock; estimated cost, $45,000.

Panama.—Bids will be received until May 1 by the Isthmian Canal Comn., Washington, D. C., for furnishing machinery, drills, steam hammers, boring machines, pneumatic machinery, etc.; also on May 2 for furnishing track tools, bolts, tie plates, boiler iron, horse rollers, etc., both advertised in The Engineering Record.

PROPOSALS OPEN

For Proposals see pages 71, 72, 76, 80 and 81

WATER WORKS.

Bids Close.		See Eng. Record.
Apr. 4.	Well, Poplarville, Miss. Adv. Mar. 18 to Apr. 1.	Mar. 18
Apr. 4.	Well, Lumberton, Miss. Adv. Mar. 18 to Apr. 1.	Mar. 18
Apr. 4.	Ellisville, Miss. Adv. Mar. 25.	Mar. 25
Apr. 4.	C. I. pipe, etc., Richmond, Va.	Apr. 1
Apr. 4.	Extension, Geneva, O.	Apr. 1
Apr. 5.	Well, Superior, Wis.	Apr. 1
Apr. 6.	Submarine pipe line, Boston, Mass.	Mar. 11
Apr. 6.	New Albany, Miss. Adv. Mar. 18, 25.	Mar. 18
Apr. 7.	Boilers, Chicago, Ill.	Mar. 25
Apr. 7.	C. I. pipe, Portsmouth, O.	Apr. 1
Apr. 10.	Main supply canal, Belle Fourche, S. D. Adv. Feb. 18 to Mar. 25.	Feb. 18
Apr. 10.	Pipe & Spcls., Winnipeg, Man. Adv. Feb. 18 to Mar. 11.	Feb. 18
Apr. 10.	Mains, Salt Lake City, Utah.	Apr. 1
Apr. 11.	Engine, Elyria, O. Adv. Mar. 25 to Apr. 1.	Mar. 25
Apr. 12.	Portage L. Prairie, Man.	Mar. 11
Apr. 12.	Pipe line, etc., St. John, N.B. Adv. Mar. 25 to Apr. 1.	Mar. 25
Apr. 12.	Pumping plant, Humboldt, Kan.	Apr. 1
Apr. 12.	Locks, etc., Brooklyn, N. Y.	Apr. 1
Apr. 12.	Graham, N. C. Adv. Apr. 1.	Apr. 1
Apr. 12.	C. I. pipe, Portland, Ore.	Apr. 1
Apr. 15.	Alma, Neb.	Mar. 11
Apr. 15.	Cookeville, Tenn.	Mar. 25
Apr. 15.	Connellsville, Pa.	Mar. 25
Apr. 15.	System, Connellsville, Pa.	Apr. 1
Apr. 15.	Well, Fernandina, Fla.	Apr. 1
Apr. 17.	Pipe line, etc., Augusta, Me. Adv. Apr. 1.	Apr. 1
Apr. 18.	Pumping engine, Toronto, Ont., Adv. Mar. 11, 18	Mar. 18
Apr. 18.	New Orleans, La. Adv. Feb. 11 to Apr. 1.	Feb. 11
Apr. 25.	Canal, pipe, etc., N. Orleans, La., Adv. Feb. 18 to Apr. 1.	Feb. 18
May 1.	Shirley, Ind.	Feb. 11
May 11.	Pipe, New Orleans, La.	Mar. 25
May 14.	System, Mansfield, La. Adv. Mar. 4, 11.	Mar. 4
May 15.	Engine, etc., Montreal, Que. Adv. Mar. 11.	Mar. 11
May 16.	Irrig. work, North Platte, Neb. Adv. Mar. 25 to Apr. 1.	Mar. 25
Jun. —.	Prescott, Wash.	Apr. 1

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Apr. 3.	Ft. Leavenworth, Kan. Adv. Mar. 11 to Apr. 1.	Mar. 11
Apr. 3.	Long Island City, L. I., N. Y.	Mar. 25
Apr. 3.	Brookline, Mass.	Apr. 1
Apr. 5.	Logansport, Ind.	Mar. 11
Apr. 5.	St. Joseph, Mo. Adv. Mar. 11.	Mar. 11
Apr. 5.	New York, N. Y.	Apr. 1
Apr. 5.	Pittsburg, Pa.	Apr. 1
Apr. 5.	Harrisburg, Pa.	Apr. 1
Apr. 6.	Alliance, O.	Apr. 1
Apr. 7.	Ft. Wood, N. Y. H., N. Y. Adv. Mar. 11 to Apr. 1.	Mar. 11
Apr. 7.	Youngstown, O.	Apr. 1
Apr. 7.	Troy, N. Y.	Apr. 1
Apr. 10.	Menominee, Mich. Adv. Mar. 18 to Apr. 1.	Mar. 18
Apr. 10.	Regina, N. W. Ter.	Apr. 1
Apr. 10.	Scottville, Mich.	Mar. 25
Apr. 10.	Renfrew, Ont.	Apr. 1
Apr. 10.	Toledo, O.	Apr. 1
Apr. 11.	Cleveland, O.	Apr. 1
Apr. 12.	Portage Le Prairie, Man.	Mar. 11
Apr. 14.	Blackwell, Okla. Ter.	Apr. 1
Apr. 15.	Puyallup, Wash.	Mar. 25
Apr. 18.	New Orleans, La. Adv. Feb. 18 to Apr. 1.	Feb. 18
May 1.	Lexington, Ky.	Apr. 1

BRIDGES.

Bids Close.		See Eng. Record.
Apr. 3.	Atlanta, Ga., Adv. Mar. 18, 25	Mar. 18
Apr. 3.	Paterson, N. J.	Apr. 1
Apr. 4.	Dayton, O. Adv. Mar. 25 to Apr. 1.	Mar. 25
Apr. 4.	Columbus, Ga.	Mar. 4
Apr. 4.	Spokane, Wash.	Mar. 4
Apr. 4.	Alma, Neb.	Feb. 18
Apr. 4.	Goldendale, Wash.	Feb. 11
Apr. 4.	Middletown, Ind.	Mar. 25
Apr. 5.	Smithland, Ky.	Mar. 18
Apr. 5.	Birmingham, Ala.	Mar. 18
Apr. 5.	Indianapolis, Ind.	Mar. 18
Apr. 5.	Langdon, N. Dak.	Mar. 11
Apr. 5.	Dakotah, Ia.	Mar. 25
Apr. 5.	Goldbeach, Ore.	Mar. 25
Apr. 5.	Algona, Ia.	Apr. 1
Apr. 5.	Lincoln, Neb.	Apr. 1
Apr. 5.	Carrington, N. D.	Apr. 1
Apr. 6.	Warrenton, Mo.	Mar. 18
Apr. 6.	Bluffton, Ind.	Mar. 18
Apr. 6.	Wabash, Ind.	Feb. 25
Apr. 7.	Anoka, Minn.	Mar. 25
Apr. 7.	Elk River, Minn.	Adv. April 1
Apr. 8.	Bloomfield, Ind.	Mar. 25
Apr. 8.	Springfield, Mass. Adv. Mar. 25 to Apr. 1.	Mar. 25
Apr. 10.	Townsend, Mont.	Mar. 25
Apr. 10.	Tillamook, Ore.	Mar. 25
Apr. 10.	New Haven, Conn. Adv. April 1.	Apr. 1
Apr. 10.	Cleveland, O.	Apr. 1
Apr. 11.	New York, N. Y.	Apr. 1
Apr. 12.	Cleveland, O.	Mar. 25
Apr. 13.	Jackson, O.	Mar. 25
Apr. 15.	Birmingham, Ala.	Apr. 1
Apr. 19.	Moscow, Idaho	Mar. 11
Apr. 19.	Cleveland, O.	Apr. 1
Apr. 21.	Cincinnati, O.	Mar. 25
Apr. 25.	Cleveland Heights, O.	Apr. 1
Apr. 26.	Denver, Colo.	Adv. April 1
May 1.	Richland, Ark.	Mar. 11

PAVING AND ROADMAKING.

Bids Close.		See Eng. Record.
Apr. 3.	Wilkesbarre, Pa.	Mar. 18
Apr. 3.	White Plains, N. Y.	Mar. 25
Apr. 3.	Long Island City, L. I., N. Y.	Mar. 25
Apr. 3.	Cortland, N. Y.	Mar. 25
Apr. 3.	Albany, N. Y.	Apr. 1
Apr. 3.	Syracuse, N. Y.	Apr. 1
Apr. 3.	Chester, Pa.	Apr. 1
Apr. 4.	Greenville, Miss.	Mar. 18
Apr. 4.	Bloomfield, Ind.	Mar. 18
Apr. 4.	Marion, Ind.	Mar. 25
Apr. 4.	Buffalo, N. Y.	Mar. 25
Apr. 4.	Amsterdam, N. Y. Adv. Mar. 25.	Mar. 25
Apr. 4.	Detroit, Mich.	Apr. 1
Apr. 5.	Peru, Ind.	Mar. 4
Apr. 5.	Paoli, Ind.	Mar. 25
Apr. 5.	Pittsburg, Pa.	Apr. 1
Apr. 5.	Bozrah, Conn.	Apr. 1
Apr. 6.	Bloomington, Ill.	Apr. 1
Apr. 6.	Danville, Ill.	Apr. 1
Apr. 6.	Hillsboro, Ore.	Apr. 1
Apr. 8.	St. Joseph, Mo.	Apr. 1
Apr. 10.	Ft. Mott, N. J. Adv. Mar. 18 to Apr. 1.	Mar. 18
Apr. 10.	Lafayette, Ind.	Mar. 25
Apr. 10.	Uhrichsville, O.	Mar. 25
Apr. 10.	Menominee, Mich. Adv. Mar. 18 to Apr. 1.	Mar. 18
Apr. 10.	Bowling Green, O.	Mar. 25
Apr. 10.	Ft. Schuyler, N. Y.	Mar. 25
Apr. 10.	Cincinnati, O.	Mar. 25
Apr. 10.	Braddock, Pa.	Mar. 25
Apr. 10.	Salt Lake City, Utah	Apr. 1
Apr. 11.	New Brighton, S. I., N. Y.	Apr. 1
Apr. 12.	Brooklyn, N. Y.	Apr. 1
Apr. 14.	Minneapolis, Minn.	Mar. 25
Apr. 14.	Cincinnati, O.	Mar. 25
Apr. 14.	Janesville, Wis.	Apr. 1
Apr. 15.	Sullivan, Ind.	Mar. 25
Apr. 15.	Cookeville, Tenn.	Mar. 25
Apr. 15.	East Cleveland, O.	Apr. 1
Apr. 17.	Cincinnati, O.	Mar. 25
Apr. 17.	Rensselaer, Ind.	Apr. 1
Apr. 17.	Montgomery, Ala.	Apr. 1
Apr. 17.	Perrysburg, O.	Apr. 1
Apr. 18.	Mankato, Minn., Adv. Apr. 1.	Apr. 1
Apr. 18.	La Crosse, Wis.	Feb. 25
Apr. 20.	Gettysburg, Pa.	Apr. 1
Apr. 21.	Cincinnati, O.	Mar. 25
Apr. 24.	Cincinnati, O.	Apr. 1
Apr. 30.	Vicksburg, Miss.	Mar. 25
May 1.	Parkridge, Ill.	Mar. 11
May 1.	Evansville, Ind.	Apr. 1

POWER, GAS AND ELECTRICITY.

Bids Close.		See Eng. Record.
Apr. 3.	Cape Charles, Va. Adv. Feb. 25.	Feb. 25
Apr. 3.	Brooklyn, N. Y.	Mar. 25
Apr. 4.	Indianapolis, Ind.	Mar. 25
Apr. 4.	Brooklyn, N. Y.	Mar. 25
Apr. 4.	Richmond, Va.	Apr. 1
Apr. 4.	Greenwood, S. C.	Apr. 1
Apr. 6.	New Albany, Miss. Adv. Mar. 18, 25.	Mar. 18
Apr. 8.	Washington, D. C. Adv. Apr. 1.	Apr. 1
Apr. 10.	Ocean Park, Cal.	Mar. 25
Apr. 11.	Shreveport, La.	Feb. 18
Apr. 11.	Washington, D. C.	Mar. 25
Apr. 11.	Ft. Caswell, N. C. Adv. Apr. 1.	Apr. 1
Apr. 12.	Lockport, Ill. Adv. Feb. 18.	Feb. 18
Apr. 12.	Graham, N. C. Adv. Apr. 1.	Apr. 1
Apr. 12.	Bristol, Conn.	Apr. 1
Apr. 15.	Alma, Neb.	Mar. 11
Apr. 15.	Cookeville, Tenn.	Mar 25
Apr. 15.	Harrisburg, Ark.	Mar. 18
Apr. 24.	Janesville, Wis.	Apr. 1
Apr. 25.	Washington, D. C.	Apr. 1
Apr. 27.	Ligonier, Ind. Adv. Mar. 25 to Apr. 1.	Mar. 25
Apr. —.	Ft. Valley, Ga.	Jan. 21
May 1.	Empire, Colo.	Mar. 18
May 1.	Shirley, Ind.	Feb. 11
May 2.	Modesto, Cal.	Mar. 25
May 15.	Jewell City, Kan.	Mar. 18
May —.	Meridian, Miss.	Mar. 25

BUILDINGS.

Bids Close.		See Eng. Record.
Apr. 3.	School, Shamokin, Pa.	Mar. 25
Apr. 3.	Court House, Hollidaysburg, Pa.	Mar. 25
Apr. 3.	School, Brooklyn, N. Y.	Mar. 25
Apr. 4.	Police sta., New Haven, Conn.	Mar. 18
Apr. 4.	School, Hattiesburg, Miss.	Mar. 18
Apr. 4.	Stable, Brooklyn, N. Y.	Mar. 25
Apr. 4.	School, Covington, Ky.	Mar. 25
Apr. 4.	Pub. Bldg., Glenwood, Ia.	Mar. 25
Apr. 4.	Dormitory, Little Rock, Ark.	Apr. 1
Apr. 5.	Hospital, Charleston, S. C.	Mar. 18
Apr. 5.	Post Bldgs., Ft. McKinley, Me.	Mar. 11
Apr. 5.	Court House plans, New Orleans, La.	Dec. 3
Apr. 5.	School, Edgeley, N. D.	Mar. 25
Apr. 5.	Poor House, Winona, Minn.	Mar. 25
Apr. 5.	School, Walkerville, Ont.	Mar. 25
Apr. 5.	School, Iowa City, Ia.	Mar. 25
Apr. 5.	School, Springfield, Mass.	Apr. 1
Apr. 5.	Bus. Bldgs., Beaumont, Tex.	Apr. 1
Apr. 6.	Post Office, Marblehead, Mass. Adv. Mar. 4, 11.	Mar. 4
Apr. 6.	Hospital, Birmingham, Ala.	Mar. 25
Apr. 6.	Hospital, Retreat, Pa.	Mar. 25
Apr. 7.	School, Freeport, Ill.	Mar. 25
Apr. 8.	Court House Plans, Deadwood, S. D.	Mar. 25
Apr. 8.	Pub. Bldg., Washington Barracks, D. C., Adv. Apr. 1	Apr. 1
Apr. 8.	School, Valley City, N. D.	Apr. 1
Apr. 8.	Bus. Bldg., Peterborough, Ont.	Apr. 1
Apr. 10.	School, Ithaca, N. Y. Adv. Mar. 4 to 18.	Mar. 4
Apr. 10.	Court House, Seward, Neb.	Mar. 25
Apr. 10.	Court House, Columbia, Miss.	Mar. 25
Apr. 10.	Court House, Tillamook, Ore.	Mar. 25
Apr. 10.	School, Wauwatosa, Wis.	Apr. 1
Apr. 10.	School, New York, N. Y.	Apr. 1
Apr. 10.	School, Corona, L. I., N	
Apr. 10.	Warehouse, Philadelphia,	
Apr. 10.	School, Jamaica, L. I., N	
Apr. 10.	School, Reno, Nev.	
Apr. 10.	School, McMechen, W. V	
Apr. 10.	School, Ann Arbor, Mich	
Apr. 10.	School, Houston, Tex.	
Apr. 10.	School, Bridgeport, Con	
Apr. 10.	School, Buffalo, N. Y.	
Apr. 11.	Pub. Bldg., Washington, Adv. Mar. 25 to Apr. 1	
Apr. 11.	Fire engine, New Ha Conn.	
Apr. 11.	School, Youngstown, O.	
Apr. 12.	Jail, Oakland, Md.	
Apr. 12.	Court House, Marion, Va	
Apr. 12.	Hotel, Shenandoah, Pa. Adv. Apr. 1.	
Apr. 12.	Capitol, Columbia, S. C.	
Apr. 12.	School, Buffalo, N. Y.	
Apr. 13.	Court House, Douglas, W	
Apr. 14.	School, Petersburg, W. V	
Apr. 15.	Court House, Corsicana,	
Apr. 15.	Court House, Grundy, Va	
Apr. 15.	Church, Trenton, Ky.	
Apr. 15.	School, Buffalo, N. Y.	
Apr. 17.	School, Richmond, Va.	
Apr. 17.	School, Harrison, N. J.	
Apr. 18.	Pub. Bldg., St. Joseph, M	
Apr. 18.	Library, Cincinnati, O.	
Apr. 19.	Boilers in Reform, Mans	
Apr. 20.	Officers' quarters, etc., Point, N. Y. Adv. Mar. 25 to Apr. 1	
Apr. 22.	Storehouse, Ft. Missc Mont.	
Apr. 22.	Pub. Bldg., Charles S. C.	
Apr. 24.	School, New York, N. Y	
Apr. 24.	Infirmary, Steubenville,	
Apr. 24.	Pub. Bldgs., Ft. Andr Peddocks Island, Mass.	
Apr. 24.	Htg. P. O. Bldg., Charlo ville, Va. (Adv. Apr. 1)	
Apr. 25.	Htg. P. O. Bldg., Pierre,	
Apr. 25.	Post Bldgs., Ft McPher Ga., Adv. Apr. 1.	
Apr. 28.	Post Bldgs., Ft. Moul Ga., Adv. Apr. 1.	
Apr. 28.	Htg. Pub. Bldg., Washin Barracks, D. C. Adv. Apr. 1.	
Apr. 30.	Court House, Wynne, A	
Apr. 30.	Bank, Buffalo, N. Y.	
Apr. —.	School, New Haven, Co	
Apr. —.	Asylum, Jamestown, N.	
May 1.	College plans, Washing D. C.	
May 1.	Remov. Pub. Bldgs., Sulp Ind. Ter.	
May 3.	Court House, Vinton, Ia.	
May 8.	Interior finish, U. S. Cus House, New York, N. Adv. Mar. 11, 18	
May 9.	Mech. Equip. U. S. Cus House, New York, N. Adv. Mar. 11, 18	
May 15.	School, Port Arthur, Te	
Jun. 15.	Court House plans, New leans, La.	

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Apr. 3.	Sprinkling, New York, N	
Apr. 3.	Park work, Boston, Mas	
Apr. 3.	Garb. Disp., South Be hem, Pa.	
Apr. 3.	Garb. Disp., Asbury N. J.	
Apr. 3.	Garb. disposal, Chester,	
Apr. 3.	Garb. disposal, Knoxville	
Apr. 4.	Cement, Winnipeg, Man. Adv. Mar. 11, 18.	
Apr. 4.	Ditch, Fairmont, Minn.	
Apr. 4.	Supplies, Washington, D	
Apr. 4.	Garb. Disp., Avalon, Pa.	
Apr. 5.	Dredging, Baltimore, M	
Apr. 6.	El. ry. franchise, Nati City, Cal.	
Apr. 6.	Gravel, New York, N.	
Apr. 7.	Garb. Disp., Holyoke,	
Apr. 8.	Dredging, Dry Tortugas,	
Apr. 8.	Ditch work, Kenton, O	
Apr. 10.	Channel work, Bermuda	
Apr. 10.	St. ry. franchise, Los A les, Cal.	
Apr. 11.	Supplies, Washington,	
Apr. 11.	Foundry equipment, Phil phia, Pa.	
Apr. 11.	Supplies, Washington,	
Apr. 13.	Cement, Panama	
Apr. 14.	Cement, stone, etc., Ft. vere, Mass. Adv. Mar. 18 to Apr. 1.	
Apr. 15.	R. R. work, Norfolk, Va. Adv. Mar. 11 to Apr. 1.	
Apr. 15.	Electric crane, Breme Wash.	
Apr. 15.	Crushing stone, Washin D. C., Adv. Mar. 25	
Apr. 17.	Dam No. 2, Pittsburg, Adv. Mar. 18 to Apr.	
Apr. 17.	Dam No. 3, Pittsburg, Adv. Mar. 18 to Apr.	
Apr. 17.	Dredging Coney Island, Harbor, Adv. Apr. 1.	
Apr. 18.	R. R. Tunnel, New N. Y., Adv. Apr. 1	
Apr. 18.	Dam No. 5, Pittsburg, Adv. Mar. 25 to Apr. 1.	
Apr. 18.	Levee work, Point a Hache, La.	
Apr. 19.	Dam No. 4, Pittsburg, Adv. Mar. 25 to Apr. 1.	
Apr. 19.	Dam, San Francisco, Adv. Mar. 25 to Apr.	
Apr. 19.	Supplies, Panama	
Apr. 24.	Garb. Crematory, Los les, Cal.	
Apr. 25.	Dredging, New Orleans,	
Apr. 27,	Trap Rock, Holyoke, Ma	
Apr. 29.	Coal handling plant, New leans, La.	
May 1.	R. R. work, Toronto, On	
May 1.	Machinery, Panama, Apr. 1.	
May 2.	Tools, etc., Panama ,A	
May 6.	Quay Wall, Bremerton,	
May 10.	Ditch, Stevens Point, W	

**Items marked thus give the names of parties awarded contracts.*